FINAL
FIELD OVERSIGHT PLAN FOR
PARCEL G REMOVAL SITE INVESTIGATION
HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

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EXECUTIVE SUMMARY

Radiological surveys and remediation were previously conducted at former Hunters Point Naval Shipyard (HPNS) as part of a series of Time-Critical Removal Actions (TCRAs) to remove sanitary sewers and storm drains, survey and sample soil at former building sites for radiological contamination, and survey buildings used by the Navy's Radiological Defense Laboratory (NRDL). Tetra Tech EC, Inc. (TtEC), under contract with the Department of the Navy (Navy), conducted most of these TCRAs, including the area known as Parcel G. Data manipulation and falsification committed by TtEC employees during the TCRAs has been verified by an independent third-party evaluation, which identified additional potential manipulation and data quality issues with data collected at Parcel G (CH2MHill, 2017, 2018). As a result, the Navy has developed a plan with a new contractor to reinvestigate radiological sites in Parcel G pursuant to the Navy's Final Parcel G Removal Site Evaluation Work Plan (the Parcel G Work Plan), dated June, 2019 (Navy, 2019).

The purpose of the Navy's investigation is to determine whether current site conditions are compliant with the remedial action objective (RAO) in the Parcel G Record of Decision (ROD) (Navy, 2009). The RAO for radiologically impacted soil and structures is to prevent receptor exposure to concentration of radionuclides of concern (ROCs) that exceed remediation goals (RGs) for all potentially complete exposure pathways. Initial sampling will be conducted in selected on- and off-site reference background areas (RBAs). Additional RBAs may be identified to confirm, or update as necessary, estimates of naturally occurring and man-made background levels for ROCs not attributed to naval operations at HPNS.

Oversight of the Navy's investigation will be performed collaboratively by the U.S. Environmental Protection Agency (EPA) and TechLaw, Inc., California Department of Toxic Substances Control (DTSC), and California Department of Public Health (CDPH). This Field Oversight Plan (FOP) discusses oversight of the RBA phase of the Navy's investigation of radiological sites in Parcel G, as well as the collection of RBA split soil samples by EPA (personnel or TechLaw, Inc.). This FOP is considered a living document and will be updated over time as components of the Navy's investigation are finalized and as conditions change. Specific details about the Navy's investigation can be found in the Parcel G Work Plan (Navy, 2019).

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ACRONYMS AND ABBREVIATIONS

App	Application
BRAC	Base Realignment and Closure
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain of custody
Electronic Checklist	Electronic Radiological Field Oversight Checklist
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
FOP	Field Oversight Plan
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations and Emergency Response
HPNS	Hunters Point Naval Shipyard
ID	Identification
IDW	investigation-derived waste
MINS	Mare Island Naval Shipyard
NAREL	National Radiation Environmental Laboratory
Navy	Department of the Navy
NRDL	Navy's Radiological Defense Laboratory
OSHA	Occupational Safety and Health Administration
PPE	personal protective equipment
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RAO	remediation action objective
RBA	reference background area
RG	remediation goal
ROC	radionuclides of concern
ROD	Record of Decision
SHSP	Site Health and Safety Plan
SOP	Standard Operating Procedure
Sr-90	Strontium-90
TCRA	time-critical removal action
TtEC	Tetra Tech EC, Inc.

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1.0 INTRODUCTION

This Field Oversight Plan (FOP) discusses oversight of each phase of the tasks and procedures that will be implemented to investigate and evaluate radiologically impacted sites in the area known as Parcel G at former Hunters Point Naval Shipyard (HPNS), San Francisco, California (**Figure 1-1**). Radiological surveys and remediation were previously conducted at former HPNS as part of a series of Time-Critical Removal Actions (TCRAs) to remove sanitary sewers and storm drains, survey and sample soil at former building sites for radiological contamination, and survey buildings used by the Navy's Radiological Defense Laboratory (NRDL). Tetra Tech EC, Inc. (TtEC), under contract with the Department of the Navy (Navy), conducted most of the TCRAs, including those in Parcel G. Data manipulation and falsification committed by TtEC employees during the TCRAs has been verified by an independent third-party evaluation, which identified additional potential manipulation and data quality issues with data collected at Parcel G (CH2MHill, 2017, 2018). As a result, the Navy will conduct investigations at radiologically impacted soil and building sites in Parcel G that were surveyed by TtEC (**Figure 1-2**) pursuant to the Navy's Final Parcel G Removal Site Evaluation Work Plan (the Parcel G Work Plan), dated June, 2019.

The purpose of the Navy's investigation is to determine whether site conditions are compliant with the remedial action objective (RAO) in the Parcel G Record of Decision (ROD) (Navy, 2009). The RAO for radiologically impacted soil and structures is to prevent receptor exposure to radionuclides of concern (ROCs) at concentrations that exceed remediation goals (RGs) for all potentially complete exposure pathways. Initial sampling will be conducted in selected on- and off-site reference background areas (RBAs). Additional RBAs may be identified to confirm, or update as necessary, estimates of naturally occurring and man-made background levels for ROCs not attributed to naval operations at HPNS.

The lead agency at HPNS is the Navy, and the lead Federal Regulatory Agency is the U.S. Environmental Protection Agency (EPA). Oversight of the Navy's investigation will be performed collaboratively by the EPA and EPA's contractor, TechLaw, the California Department of Toxic Substances Control (DTSC), and the California Department of Public Health (CDPH). This FOP is considered a living document and will be updated over time as components of the Navy's investigation are finalized and as conditions change. Specific details about the Navy's investigation can be found in the Parcel G Work Plan (Navy, 2019).

1.1 Background

The HPNS began operations in 1939 and housed an active naval military base until it was closed in 1974. However, the shipyard only functioned as an active Navy-run repair facility from 1939 through 1974. From 1946 through 1969, the NRDL and its predecessors did radiological experiments at HPNS. From 1946 to 1951 HPNS radiological operations also included attempts to decontaminate ships that were contaminated by the nuclear experiments at Operation Crossroads. After HPNS ceased to function as an operational Navy shipyard in 1974, some HPNS buildings and structures were leased in 1976 to private tenants and Navy-related entities, the largest of which was Triple A Machine Shop, Inc., for ship repair operations. Buildings at

HPNS have also been leased for maritime and non-maritime industrial and artistic purposes. In addition, the Navy continued to use some buildings and structures for on-site oversight activities. The Navy resumed occupancy of the shipyard in 1990, when HPNS was assigned as an annex to Naval Station Treasure Island. Between November 1985 and August 1989, Mare Island Naval Shipyard used HPNS to dock and repair approximately 10 ships, including some that were nuclear-powered. Throughout its history, HPNS has been the subject of many radiological investigations. These investigations continue today. Shipyard operations were permanently terminated on 29 December 1989. In 1991, HPNS was placed on the Navy's Base Realignment and Closure (BRAC) list and its mission as a Navy shipyard ended on 1 April 1994.

Radiological operations at the site included the repair, use, and disposal of radioluminescent commodity items (dials, gauges, and deck markers), as well as various research projects as follows:

- Gamma radiography for testing of metal and welds
- Calibration laboratory operations for ensuring radiation survey instrument accuracy
- Decontamination of and scientific research on ships contaminated during atomic weapons testing
- Effects of radiation on animals
- Effects of radiation on ships
- Use of various radionuclides for scientific research by the NRDL and its predecessors
- Mare Island Naval Shipyard (MINS) used berthing and dry-dock facilities at HPNS between 1985 and 1989 for work on nuclear-powered ships

Since the base was closed, numerous radiological investigations and remediation activities have occurred. As part of a basewide TCRA, sanitary sewers and storm drains were removed in accordance with the Action Memorandum (Navy, 2006). TtEC, under contracts with the Navy, conducted most of the basewide TCRA from 2006 to 2015. However, there have been various allegations of data manipulation or falsification committed by TtEC employees and TtEC's subcontractors during the TCRA. An independent third-party evaluation of previous data found evidence of manipulation and falsification at Parcel G (CH2MHill, 2017, 2018). As a result, the Navy has developed a work plan to re-investigate radiological sites in Parcel G. The Regulatory Agencies, including the EPA in coordination with DTSC and CDPH, will provide oversight of the re-work planned to be conducted at the site in order to ensure adequate quality controls (QCs) are in place to ensure the integrity of the investigation. Regulatory oversight is also intended to ensure the project meets the statutory cleanup requirements under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and to provide reassurance to current and future home owners in the area and the general public that conditions at the HPNS site are safe for residential and commercial re-use.

1.2 Oversight Objective

EPA, TechLaw, DTSC, and CDPH (herein referred to as the Oversight Team) will serve in a compliance oversight capacity during the Navy's investigation. The Oversight Team will observe all field activities conducted by the Navy's contractor and collect and arrange for

analysis of split soil samples to verify that all EPA-approved sampling protocols are adhered to in the field and that analytical data are reproducible, accurate, and obtained by following the appropriate quality assurance (QA) procedures.

2.0 OVERSIGHT APPROACH

The Oversight Team will provide a minimum of one qualified individual to represent EPA in an oversight capacity at all times during field RBA scanning and sampling that are conducted by the Navy's contractor. Qualified oversight personnel will be familiar with the objectives and procedures detailed in the Parcel G Work Plan and the Final Quality Assurance Project Plan for Parcel G Removal Site Investigation Split Soil Sampling, Hunters Point Naval Shipyard, San Francisco, California, dated August 2019 (the Split Sampling QAPP) and experienced in environmental sampling techniques. In addition, the Oversight Team will be trained in radiological survey methods, techniques, and instruments that will be used to scan the RBAs before samples are collected. EPA will conduct independent scanning of the RBAs. The Oversight Team will also package and ship split samples at a rate of 10% per RBA. The split samples will be provided by the Navy's contractor after soil is homogenized using an alternate spooning technique between the primary sample container and the split sample container (Attachment D).

2.1 Preparation Prior to Field Oversight

The following items should be performed before site activities are initiated:

- Obtain and review a copy of the applicable documents (i.e., Parcel G Work Plan, Split Sampling QAPP, etc.) to become familiar with the activities that will occur while on-site.
- Gather all required personal protective equipment (PPE) as required by the Site Health and Safety Plan (SHSP) and the facility.
- Attend special trainings ahead of the oversight event (scheduled for August 9th and 12th) to cover facility-specific hazard awareness, evacuation protocol, site orientation, etc.
- Make copies of all relevant certifications and health and safety information (e.g., 40-hour Occupational Safety and Health Administration [OHSA] Hazardous Waste Operations and Emergency Response [HAZWOPER], 8-hour Refresher, Respirator Fit Test, 8-hour Site Supervisor, CPR/First Aid, medical clearance); this documentation must be brought to the site.
- Print out the approved SHSP, read through and sign on the appropriate pages; also, fill out the medical form (in case of emergency), place in envelope, attach to the back of the SHSP and bring to the site.
- Exchange contact information (e.g., cell phone numbers) with the on-site facility representative(s) and EPA field team members in case of last-minute schedule changes, emergency situations, etc.
- Obtain supplies for performing field oversight (see Section 3.5 below).
- Test the Field Data Collection tablet (the tablet) and associated applications (Field Data Entry Form in Excel, and the Radiological Field Oversight Checklist [the Electronic Checklist]) and devices (e.g. field printer, Global Positioning System [GPS] etc.).

2.2 Documentation of Oversight Activities

Field oversight documentation will include recording information in a field logbook, taking photographs on the tablet, recording information in the Field Data Entry Form in Excel on the tablet, and recording information on the Electronic Checklist on the tablet. The requirements for field oversight documentation are discussed in the following sections.

2.2.1 Dedicated Field Logbook

During all field activities, oversight personnel maintain a daily record of observations, other than those recorded on the Field Data Entry Form and the Electronic Checklist in a dedicated field logbook. The TechLaw Standard Operating Procedure (SOP) for Maintaining a Field Logbook can be found in Attachment G. Field logbook entries must be legible, factual, detailed, and objective. Proper field documentation is crucial in the logbook because the logbook may ultimately become part of the public record and may be used in future legal actions. The field logbook must provide sufficient documentation to enable participants to reconstruct events that occurred and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings.

Information is generally listed in chronological order in the field logbook and by the time of day. All times are to be entered in a 24-hour format (e.g., 7:00 p.m. is 1900). All factual information obtained during field activities must be recorded in the logbook. Information that is not in or referred to in the logbook, the Field Data Entry Form, or the Electronic Checklist, may not be used in deliverables associated with the field work. The field logbook contains only factual information (i.e., no conclusions are recorded in the logbook). Weather conditions are documented at least twice per day and must be noted immediately with any significant weather change (e.g., thunderstorm).

Site sketches are often used in conjunction with written descriptions. All sketches must include a north arrow, a rough scale, and position of and approximate distance to buildings or other notable site features (e.g., trees, streets, trails etc.).

Information that may be recorded in the field logbook may include, but is not limited to, the following:

- Initial start time, date, and weather conditions
- Participants and their affiliation
- Summary of primary health and safety considerations and necessary PPE
- A complete description of activities
- Brief site description (i.e., distance to nearest slope, whether flat or sloped, surface conditions (soil type, vegetation etc.)
- Number, type, and location of samples collected, including split soil samples
- Field procedures applied (e.g., sampling techniques, decontamination procedures)
- Deviations from the Parcel G Work Plan or the Split Sampling QAPP
- Deviations from SHSP

- Summary of conversations with the site personnel regarding site activities, discrepancies between the oversight personnel's field observations and field data recorded by the Navy's contractor
- Documentation of any problems encountered during oversight activities (e.g., the Oversight Team was prevented from taking photographs, split sampling request was refused by the Navy's contractor, etc.)
- Description of the preparation of a sampling location
- Time at which each sample was collected, including split samples
- Calibration procedures, if applicable
- Appearance of the sample (e.g., evidence of staining, debris, etc.), including split samples
- Parameters for which the sample is to be analyzed, including split samples
- Any other relevant information

The field logbook is the property of TechLaw, Inc. Once a logbook is filled up, the logbook must be scanned and a copy will be provided to the EPA and placed in the central project files (hardcopy and electronic) as soon as possible. When the project is complete, any partially completed log books will also be scanned and provided to the EPA as soon as possible.

2.2.2 Site Photographs

Photographs should be taken at each RBA using the camera application (app) on the tablet. Photographs serve to verify the written description in the field logbook and the Field Data Collection Forms. The following information should be recorded in the field logbook for each photograph taken:

- Description and identification of the subject in the photo
- Description of the orientation captured in the photo and the approach (e.g., standing on the north side of the RBA looking south)
- The photograph time stamp automatically generated and associated with the tablet photo
- Name and affiliation of the person taking the photograph

A minimum of five photographs should be taken at each RBA, including one photo of the RBA and a photo facing each direction (north, south, east, and west) from the RBA. Each split sample location should also be photographed, including both the field location and photographs of the sample in the sampling device (e.g., split spoon). Additional photographs should be taken of any significant features identified near the sample location (e.g., structures, discolored ground, radiological objects etc.). It is anticipated that radiological objects will be identified by the Navy contractor

2.2.3 Electronic Field Data Collection

In addition to the dedicated field logbook and photographs, oversight personnel are required to complete the Field Data Collection Form in Excel on the tablet for each split sample and the online Electronic Checklist (hard copy example provided in Attachment A) once per day that field activities are conducted and per Navy contractor team observed. The actual Soil Sampling

data, such as Sample Identification (ID), Sampler, Depth, etc. will be logged in the Field Data Collection Form in Excel. It will then all be saved, after each entry at each sample location, able to be accessed and downloaded later. Site photographs will be collected on the tablet camera app and GPS coordinates will be collected using a Trimble GeoExplorer 2008 Series. It is anticipated that the Navy will not provide GPS data until a hard copy of the final report is issued. As a result, TechLaw will store coordinates from the GPS unit on the Trimble unit using waypoints and the data will be downloaded at the end of each field day. The coordinate data can then be copied to the Field Data Collection Form in Excel to minimize input error and used for mapping split sample locations.

The Electronic Checklist serves as a detailed record of the qualifications of and the activities performed by the Navy's contractor. The use of the Electronic Checklist does not supersede the field logbook, which is the legal documentation of activities conducted during the field event. A web-based electronic version of the Electronic Checklist will be used in the field and will upload automatically to the cloud upon completion of each form. This Sampling Event will have mobile WiFi using a MiFi device, and as a result, the Electronic Checklist is set-up to run while connected to a WiFi network. The use of the Electronic Checklist will improve QC, eliminate the need to enter data from the Checklist twice, and improve the efficiency of the oversight documentation process.

Sample labels will be generated prior to sampling. The labels will contain pre-printed sample IDs, locations, sample preservation, analyses, and intended laboratory. The labels will also contain blanks for the sample date, time and sampler to be written in the field. After the sample information has been written onto the labels they will be taped over on the sample bag with clear packing tape to protect the label. If there is a change in sample information, or an error is identified with the label information in the field, a single line through of the erroneous information, along with the sampler initial and date and clearly handwritten correction may be added. A note in the field logbook should also be added if changes are made to the sample label information. The chains-of-custody (COCs) will be generated electronically and printed prior to shipment. One COC will contain samples that will be shipped to Pace Analytical for strontium-90 (Sr-90) analysis (approximately 30-40 grams required), and another COC will contain samples that will be shipped to the National Radiation Environmental Laboratory (NAREL) for analysis of all other ROCs (500-650 grams required).

2.2.4 Additional Documentation Requirements

All field documentation will be maintained with the completeness and integrity to allow their use in subsequent litigation. All recordings should be factual, detailed, and objective. For more detailed information on maintaining the logbooks see Attachment G. All field documentation discussed in this FOP is the property of the EPA and will be turned over to the EPA upon their request.

2.3 Communication

Communication between oversight personnel and the Navy's contractor regarding field observations and relevant health and safety issues will be an essential part of the oversight activities. Direct communication with the Navy's contractor will be conducted in a manner that facilitates completion of the appropriate field procedures while maintaining a professional relationship between the Oversight Team and the Navy. In addition, communication between oversight personnel and the Navy's contractor will be required to ensure coordination of the times and places of planned sample collection activities so that oversight personnel are present to observe all field activities and collect the planned split samples.

Unauthorized visitors are not permitted within the designated work zones. Oversight personnel are not permitted to communicate with individuals outside of the Oversight Team, Navy, and Navy's contractor (e.g., members of the press, local residents, etc.) unless otherwise directed by the EPA or in an emergency so as not to disclose any information about site activities. Inquiries about the site or site activities should be deferred to the EPA.

Oversight personnel do not have authority to stop or impede the progress of the Navy's investigation when discrepancies arise between the observed field activities and the Parcel G Work Plan. Discrepancies should be communicated to the EPA directly and immediately. In addition, oversight personnel are not permitted to provide any field materials (e.g., PPE, sample containers, field equipment, etc.) to the Navy's contractor.

Following are examples of common field discrepancies for which the oversight representative should be aware:

- Failure to calibrate field equipment prior to use
- Samples are not collected according to the approved procedure (e.g., incorrect location, incorrect frequency, incorrect field preparation, etc.)
- Cross-contamination issues (e.g., failure to change gloves between sample locations, heavy equipment moved from one area to another without decontamination, reusing sampling equipment that has not been properly decontaminated)

2.4 Oversight Training

At least two days prior to the commencement of field sampling activities, a Health Physicist or equivalently trained representative from either the EPA or CDPH will meet with EPA, DTSC, and CDPH personnel assigned to provide field oversight to familiarize them with the equipment and radiological survey techniques that will be conducted as part of the RBA sampling and Parcel G trenches, land areas, and buildings.

Training will be conducted to cover the following items:

I. Gamma Scanning Instrument Checks and the associated calibration documentation from the manufacturer for Land Area surveys as follows

A. Instruments have a current calibration label from the manufacturer that is verified daily before use.
B. Instrument physical condition:
    1. General condition of instrument case and detector – no punctures present on probe or probe windows
    2. Knobs, buttons, cables, and connectors in good working condition
    3. Display is working
    4. Battery checked to ensure sufficient voltage is being supplied to detector and all circuitry is operating correctly
C. Daily or weekly background count
D. Source-response check:
    1. Verify that the instrument response is within the plus or minus 20 percent range determined during the initial response check.
    2. If instrument response not within plus or minus 20 percent range, or outside of control chart standard deviation limits, verify the instrument is removed from service until the issue is resolved.

II. Overseeing Gamma Scan Surveys (Ludlum 2241 SOP, see Attachment E):

A. Scanning technique, including distance to surface and scan rate
B. Data acquisition and record keeping
    1. Readings in counts per minute (cpm)
    2. Readings in disintegrations per minute (dpm) and calculations
    3. For multi-channel analyzers, discussion of regions of interest and radionuclide quantitation
C. Scanning Investigation Levels (ILs) and requirements for collecting static measurements and/or soil samples
D. Static measurements techniques and count time requirements

III. Review of the Navy's Work Plan and the Split Sampling QAPP

A. Split Sample Collection
B. Sample radiation screening
C. Sample labeling, packaging and shipping

IV. Decontamination and Cross-contamination prevention

A. Proper decontamination of equipment and materials
B. Cross-contamination prevention and techniques
C. End-of-day swipe sampling techniques
    1. Dry swipe samples of the rad meter will be collected to assess potential removable contamination. The swipes will be scanned to verify the meter is free of contamination at the end of each day and compared to measurements using a clean unused swipe as verification.

V. Waste Accumulation, Storage, and Disposal

All investigation-derived waste (IDW) will be managed by the Navy.

VI. Use of the Excel Field Data Collection Form and the online Electronic Checklist

A. Field Data Collection Instructions (Attachment C)
B. Field Data Collection Form (Attachment F)

3.0 SOIL REFERENCE BACKGROUND AREAS

RBA samples will be collected during the Navy's investigation to support final decision on whether residual radioactivity is found to exceed the RGs at HPNS. Details for the radiological characterization of soil RBAs at HPNS can be found in Appendix C, Final Soil Reference Background Area Work Plan, of the Parcel G Work Plan.

There are four onsite RBAs and one offsite RBA (San Bruno Mountain State Park) that have been identified for background radiological characterization. Radiological surveys and remediation have been conducted at HPNS as part of the basewide TCRAs. In addition to evaluating whether residual radioactivity is found to exceed the RGs, the RBA data will be compared the Navy's RBA data and the Navy will calculate background values that will be used to determine whether further remediation is necessary.

The RBAs should be located in areas that are not at the bottom of a slope or near a slope because run-off may concentrate cesium-137 (from atmospheric fallout). The offsite RBA can be on a gentle slope (less than 15 degrees), since the terrain is more variable, but not a steep slope (where too much erosion could occur).

Each RBA will be investigated using a combination of gamma scan measurements and surface and subsurface soil sampling. Surface and subsurface soil samples will be collected by the Navy's contractor in accordance with the Soil Sampling SOP (Parcel G Work Plan Worksheet #21 and Attachment 2). All split sample activity information (e.g., sample IDs, date, time, location, type, analyses, etc.) will be logged into the tablet in the Excel Field Data Collection Form, which will be saved after each entry at each split sample location, able to be accessed and downloaded later.

At each RBA, 100 percent of the accessible surface (i.e., ground level surface) will be scanned for gamma activity by the Navy's contractor and EPA using the instruments and procedures specified in Appendix C of the Parcel G Work Plan and the SOP for the Ludlum Model 2241 (see Attachment E). Both gross gamma and gamma spectral measurements will be collected simultaneously during the gamma scan. The Oversight Team will observe the scanning and fill out the Electronic Checklist and field logbook. The Electronic Checklist will be accessible on the tablet in the field via WiFi. The Oversight Team will fill out the necessary information at

least once per day that field activities are conducted and per Navy contractor team observed and then submit the form in real time to an online server database.

The Navy's contractor will collect 50 soil samples, consisting of 25 surface and 25 subsurface soil samples from each of the on-site RBAs (for a total of 200 samples) and 100 soil samples, consisting of 50 surface and 50 subsurface soil samples from the off-site RBA (for a total of 100 samples). The sampling design and rationale are described in detail in Appendix C of the Parcel G Work Plan. Split sampling procedures are discussed in the Split Sampling QAPP.

3.1 Oversight of Soil RBA Sampling Activities

The Oversight Team will observe each day of gamma scanning of 100 percent of the land areas designated as the survey units, the completion of any static gamma measurements, and the soil sampling activities. Field oversight personnel will observe all activities described in this FOP and will complete all required field documentation.

3.2 Dates of Soil RBA Sampling Activities

RBA soil sampling activities will be conducted from August 12, 2019 to August 29, 2019.

3.3 Oversight Personnel

The following table presents the names of personnel who will conduct field oversight of the soil RBA sampling activities:

Name	Affiliation	Scheduled Oversight Dates	Oversight Assignments
Dante Rodriguez	EPA	8/12-8/14	Field Team Lead/EPA scanning
Vivian Lopez	TechLaw, Inc.	8/12-8/16	Split sampling/electronic checklist
Kelsey Bartling	TechLaw, Inc.	8/19-8/23 and 8/26-8/29	Split sampling/electronic checklist
Nina Bacey	DTSC	TBD	Oversight
Shane Reese	CDPH	TBD	Oversight
Richard Francis	EPA	8/15-8/16 and 8/26-8/27	Oversight
Mary Aycock	EPA	8/19-8/20 and 8/28-8/29	Oversight
Andrew Bain	EPA	8/22-8/23	Oversight
David Kappelman[1]	EPA	8/12-8/14	Scanning/Oversight
Lyndsey Nguyen[1]	EPA	8/12-8/14	Scanning/Oversight

[1]Qualification - Health Physicist

3.4 Split Soil Samples

Split soil samples are to be collected at a minimum rate of 10 percent of the environmental samples collected by the Navy's contractor. Specific details regarding the collection and analysis of the split soil samples can be found in the Split Sampling QAPP and the Navy's Split Sampling Procedure (Attachment D).

Oversight personnel will select the location of each split soil sample based on the available soil volume (i.e., there may be shallow bedrock at some RBA locations which will limit the ability to collect sufficient soil to be analyzed by the Navy's contracted laboratory and the EPA laboratory). Split samples will not be collected at locations where the Navy contractor is collecting duplicate samples to ensure that there is sufficient soil to be analyzed. However, it is recommended that the split soil samples be collected earlier in the collection process to ensure the required frequency is met.

The following table presents the number of samples to be collected at each RBA:

RBA Location	No. of Environmental Samples	No. Split Soil Samples[1]
RBA-1 On-site	25 surface, 25 subsurface	5
RBA-2 On-site	25 surface, 25 subsurface	5
RBA-3 On-site	25 surface, 25 subsurface	5
RBA-4 On-site	25 surface, 25 subsurface	5
RBA-San Bruno Off-site	50 surface, 50 subsurface	10

[1]Each split sample will be divided into two aliquots, for a total of 60 split samples. One aliquot will be shipped to Pace Analytical for strontium-90 (Sr-90) analysis (approximately 30-40 grams required), and the second aliquot will be shipped to NAREL for analysis of all other ROCs (500-650 grams required). Each split sample aliquot will be weighed in the field with a scale to ensure sufficient sample volume will be shipped to each laboratory.

3.5 Field Supplies

Field supplies and equipment for split sampling are expected to include:

- PPE, which may include nitrile gloves, hard hat, safety glasses, steel-toed boots, traffic vest, hearing protection, etc.
- Gallon-size ziptop baggies
- Quart-size ziptop baggies
- Paper towels
- Sample labels
- Custody seals
- Dedicated field logbook
- Pens (black or blue indelible ink) and permanent markers
- Hardcopies of the Radiological Field Oversight Checklist (as backup only)
- Ludlum Model 2241 (for scanning samples prior to shipment)
- Ruggedized tablet PC with camera (Model No. SV-88H), loaded with the Electronic Checklist and the Excel Field Data Collection Form.
    - Stylus pen
    - USB cable
    - OTG cable
    - Power adapter
    - Hand strap

  - MiFi
- Scale
- Field printer or pre-printed chain-of-custody forms
- GPS Unit (for independent record of sample locations)
- Sturdy shipping boxes and coolers
- Packaging tape
- Shipping labels
- Trash bags
- Tyvek suits and overboots (for use at the off-site RBA due to the presence of Poison Oak)
- Duct Tape (to tape nitrile undergloves to Tyvek suits; nitrile overgloves will be changed for each sample, and as otherwise necessary during sampling at the off-site RBA; also to seal sample ziptop bags since EPA custody seals may fall off)
- Other recommended items include rain gear, sunscreen, insect repellent, power converter for car, wireless internet card, and compass
- Drinking water
- Backpack
- First aid kit
- Swipes for rad meter swipe sampling

4.0 REFERENCES

Navy, 2006. Basewide Radiological Removal Action, Action memorandum – Revision 2006, Hunters Point Shipyard, San Francisco, California, April.

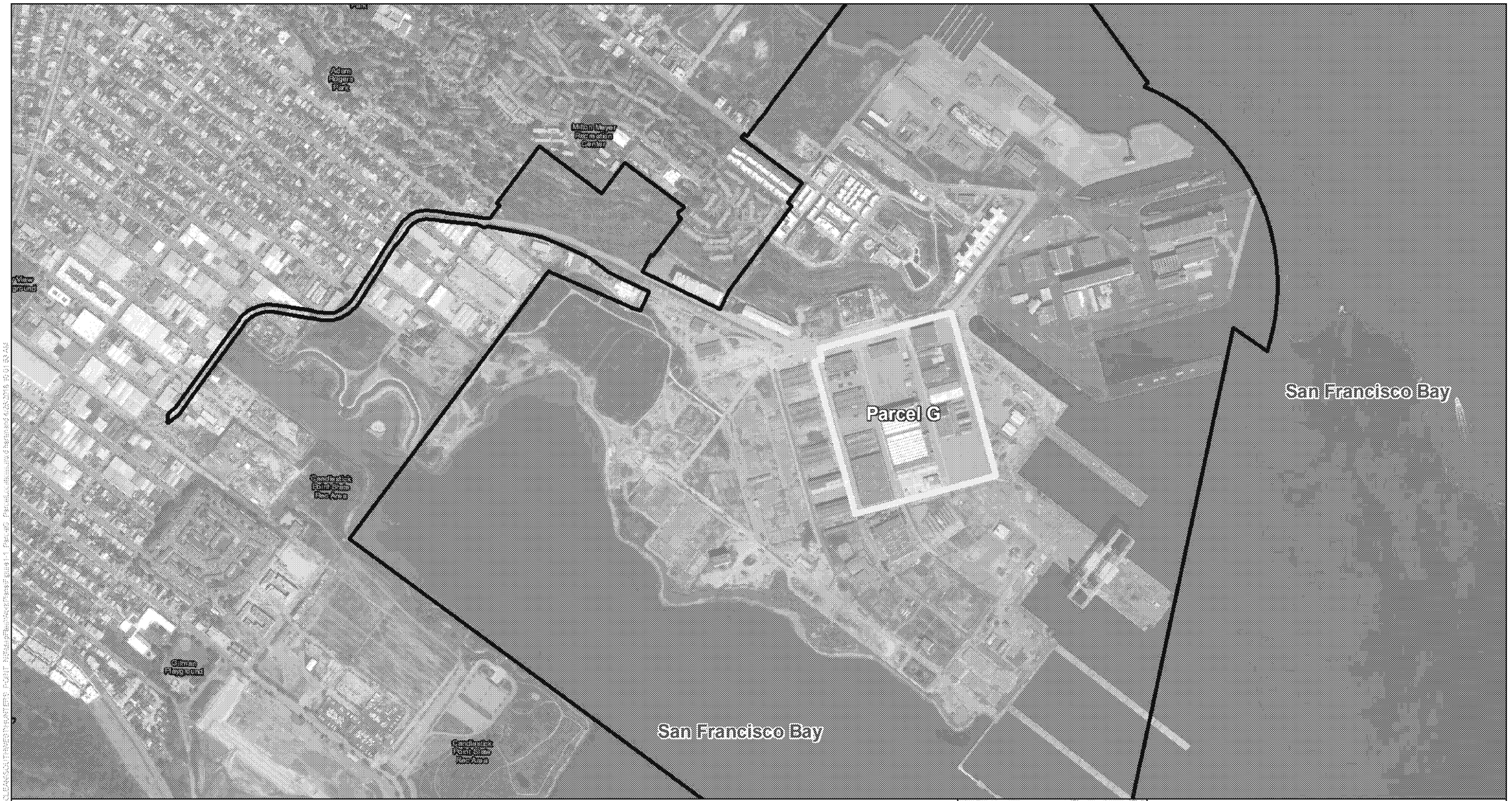
Navy, 2009. Record of Decision for Parcel G. Hunters Point Shipyard, San Francisco, California, February.

CH2MHill, 2017. Radiological Data Evaluation Findings Report for Parcels B and G Soil. Former Hunters Point Naval Shipyard, San Francisco, California. Draft. September.

CH2MHill, 2018. Building Data Initial Evaluation Report, Former Hunters Point Naval Shipyard, San Francisco, California. Draft. February.

Navy, 2019. Parcel G Removal Site Evaluation Work Plan, Former Hunters Point Naval Shipyard, San Francisco California. Final. June.

FIGURES



Legend:

- Installation Boundary
- Parcel G

BASE MAP SOURCE:
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,

N

0 400 800 1,600 Feet

1 inch = 800 feet

Overview Map

Figure 1-1
HPNS and Parcel G Location
Parcel G Work Plan
Former Hunters Point Naval Shipyard
San Francisco, California

CH2M-9000-FZ12-0013, JUNE 2019

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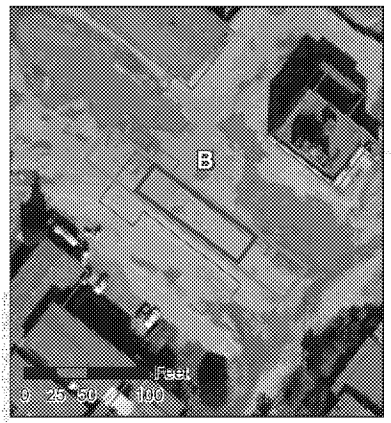
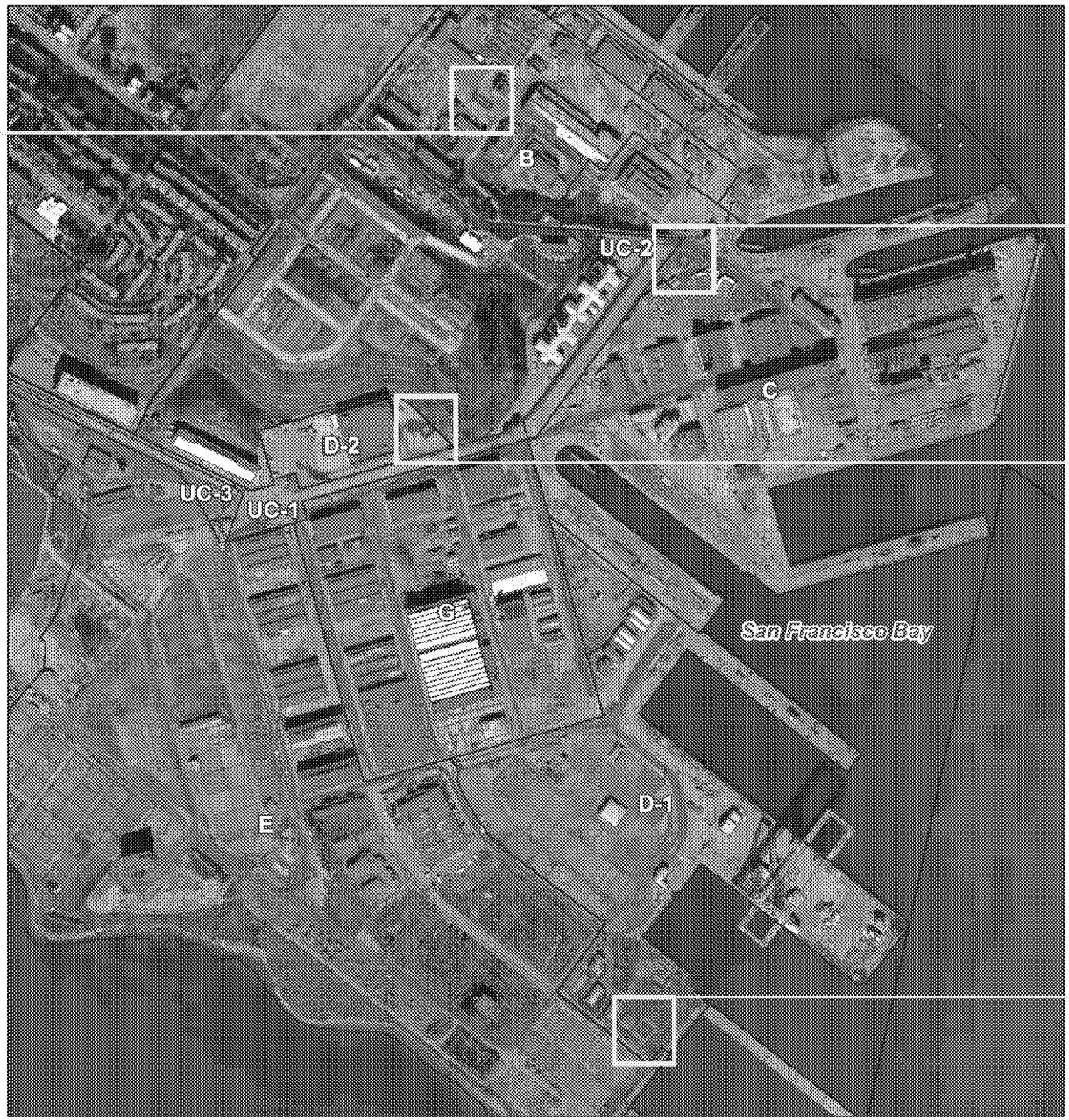
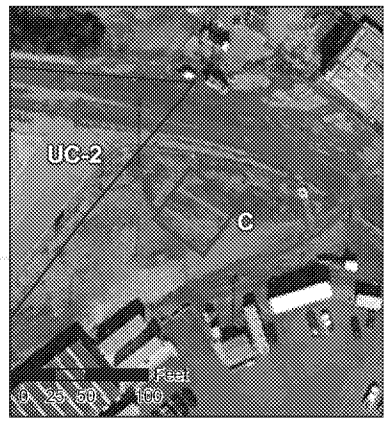
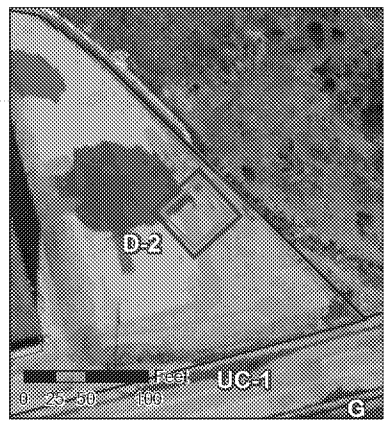
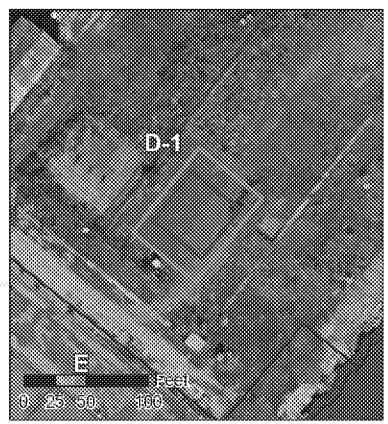










Legend:

- Reference Background Area
- Historical Reference Background Area
- Installation Boundary
- Parcel Boundary
- Current and Former Building Site

N

Feet
0 250 500 1,000

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 1-2
HPNS Reference Background Areas
Soil Reference Background Area Work Plan
Former Hunters Point Naval Shipyard
San Francisco, California

ATTACHMENT A

Field Oversight Checklist for Background Reference Area Scanning and Sampling

RADIOLOGICAL FIELD OVERSIGHT CHECKLIST

FORM NUMBER: _____

Date/Time: _____ Weather_____

Site: Hunters Point Shipyard _____ Observer: _____

Location: _____ Field Contractor: _____

Field Team Names: _____

_____

Personnel Qualifications:

Qualifications Based on Senior Health Physics Technician (Nuclear Regulatory Commission) or Senior Radiological Control Technician (Department of Energy)?

_____

	Yes	No	N/A	Comments
(1) Name(s):_____				
Are training records available on site for review?	☐	☐	☐	_____
College degree/certificate as Radiological Control Technician (RCT)?	☐	☐	☐	_____
American National Standard Institute (ANSI) 3.1 Senior (NOT 18.1)?	☐	☐	☐	_____
DOE CORE RCT qualification?	☐	☐	☐	_____
National Registry of Radiation Protection Technologist?	☐	☐	☐	_____
Minimum 5 years' experience Senior Technician?	☐	☐	☐	_____
How many years? _____				
United States Navy Nuclear Power School?	☐	☐	☐	_____

Observer initials _____

	Yes	No	N/A	Comments
(2) Name: _____				
Are Training records available on site for review?	☐	☐	☐	_____
College degree/certificate as Radiological Control Technician (RCT)?	☐	☐	☐	_____
American National Standard Institute (ANSI) 3.1 Senior (NOT 18.1)?	☐	☐	☐	_____
DOE CORE RCT qualification?	☐	☐	☐	_____
National Registry of Radiation Protection Technologist?	☐	☐	☐	_____
Minimum 5 years' experience Senior Technician?	☐	☐	☐	_____
How many years? _____				
United States Navy Nuclear Power School?	☐	☐	☐	_____
(3) Name: _____				
Are Training records available on site for review?	☐	☐	☐	_____
College degree/certificate as Radiological Control Technician (RCT)?	☐	☐	☐	_____
American National Standard Institute (ANSI) 3.1 Senior (NOT 18.1)?	☐	☐	☐	_____
DOE CORE RCT qualification?	☐	☐	☐	_____
National Registry of Radiation Protection Technologist?	☐	☐	☐	_____
Minimum 5 years' experience Senior Technician?	☐	☐	☐	_____
How many years? _____				
United States Navy Nuclear Power School?	☐	☐	☐	_____

Observer initials _____

Operation	Yes	No	N/A	Comments

Field Conditions and Best Practices for Sampling

1. What instrument was used? _____

2. Are logbooks being used to record site conditions, signed and dated? ☐ ☐ ☐ _____

3. Are COCs being properly filled out and signed, and are samples maintained under custody until signature release to shipping carrier? ☐ ☐ ☐ _____

4. Are samples appropriately checked for contamination before shipping? ☐ ☐ ☐ _____

   Describe the method(s) used to release samples (i.e., radiological screening):

   _____

   _____

   _____

8. What measures are being taken to prevent cross contamination? _____

   _____

Gamma Scanning Instrument Checks

1. What instrument models are being used? _____

2. Are Gamma detection system annual calibration records available? ☐ ☐ ☐ _____

3. Are instruments that have questionable physical condition or which have failed any of the operation checks in SOP RP-108, Count Rate Instruments, or SOP RP-109, Dose Rate Instruments, removed from service? ☐ ☐ ☐ _____

4. Are in-service and out-of-service instruments logs present? ☐ ☐ ☐ _____

Observer initials _____

Operation	Yes	No	N/A	Comments
5. Do out-of-service instruments/detectors have an "out of service" tag or equivalent on the instrument and secured in a separate area such that the instrument or instrument/detector combination cannot be issued for use?	☐	☐	☐	_____
6. Were the Project Radiation Safety Officer (PRSO) and Radiological Control Technician (RCT) and their respective supervisors notified immediately when instrumentation was placed "out of service?	☐	☐	☐	_____
7. Are initial efficiency and background checks being performed?	☐	☐	☐	_____
8. Is a check source being used daily to verify that the instrument response is within the +/- 20% range of the initial response check?	☐	☐	☐	_____
9. Are daily checks on GPS and location recording being conducted, and is the proper coordinate system being used?	☐	☐	☐	_____
10. Is the geometry of the surface being scanned the same as the geometry the instrument was calibrated for? (i.e., does the matrix primarily consist of soil; is it dry or wet; are there large rocks or cement or other materials present in the soil to be surveyed)?	☐	☐	☐	_____
a. If the soil being surveyed is wet, or other large chunks of material such as cement or rock are present, does the scanning survey instrument have an alternate geometry set up for such a matrix?	☐	☐	☐	_____
b. If not, how was this problem resolved (i.e., was soil allowed to dry before scanning, were rocks/other material removed prior to scanning?	☐	☐	☐	_____

Observer initials _____

Operation	Yes	No	N/A	Comments
11. Is the scan speed and the detector distance to the surface being verified to ensure the work plan is being followed so MDCs are achieved?	☐	☐	☐	_____
12. Is continuous scanning or continuous static (6 second measurement) method being used?	☐	☐	☐	_____
13. Are elevated readings identified and recorded, and biased statistics and/or samples collected from all areas identified with elevated readings?	☐	☐	☐	_____

How often are anomalies reviewed? _____

14. Describe procedures for identifying how the reference area boundaries locations are identified and marked._____

_____

Soil Sampling

1. Were correct number of systematic samples collected based on the work plan?	☐	☐	☐	_____
2. Were different visible types of soil sampled?	☐	☐	☐	_____
a. How many types of soil are visible?				_____
3. Were samples collected in correct containers and using appropriate sample collection tools?	☐	☐	☐	_____
4. Are instruments and sampling equipment decontaminated in accordance with SOP's ?	☐	☐	☐	_____
5. Were samples handled to prevent cross contamination?	☐	☐	☐	_____
6. Are samples checked for radioactivity prior to shipment?	☐	☐	☐	_____

Observer initials _____

Additional comments/observations: _____

_____

_____

_____

_____

_____

_____

_____

_____

Observer initials _____

ATTACHMENT B

Tablet Quick Start Guide

Quick Start Guide

Ruggedized Tablet PC

Model No.: SV-88H

Thank you for choosing our rugged tablet PC.This quick start guide provide an overview of the tablet functions and operations to ease your using in short time.

Contents

Chapter I - What's included in the package

Chapter II - Safety Precautions

Chapter III - Start to use

- Key Layout and Definitions
- Power On
- Power off (shut down) / sleep / restart
- Connecting to a WiFi network

Chapter IV - Get familiar to Windows

- Initial setup
- Start screen tiles customization
- The Windows 10 Interface

Chapter V – Special Function Module

Chapter VI – Accessories

Chapter I What's included in the package

--The rugged tablet
- Active stylus pen
- USB cable
- OTG cable
- Power adapter
- Hand strap

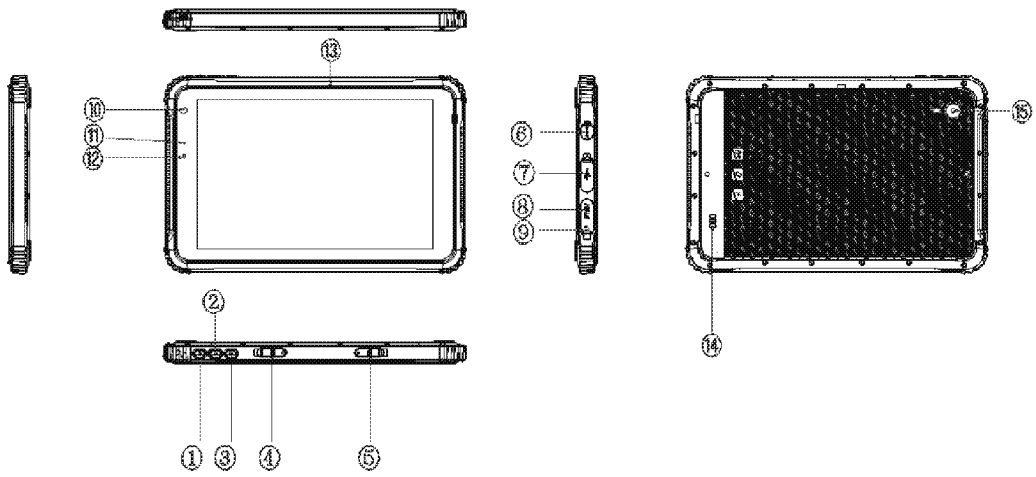
Remarks: The accessories supplied in the package may varies depending on your region or service provider.

Chapter II Safety Precautions

1, A third party power adapter may cause battery explosion danger. Be sure to use the original battery supplied in the box.
2, Please always back up your important data. The manufacturer shall not take responsibility for data missing due to accidence, or during hardware & software maintenance.
3, Please use the tablet in recommended temperature range, which is from -15 ~ 55 celsius. 4,
4, Do not operate the tablet in environment with extreme electrostatic fields or magnetic fields. The LCD panel could be damaged in extreme electrostatic fields or magnetic fields.
5, Do not disassemble the tablet. We don't provide warranty for disassembled items.
6, if the tablet is dropped into water or other non-corrosive liquids, please check the ports immediately. If all ports are sealed perfectly in position, you can use clean and dry cloth to wipe off water and continue to use the tablet.

Chapter III - Start to use

- **Key Layout and Definitions**



①Power button: to start or close touch screen panel. You can also let the computer to sleep or wake up from hibernation mode

②③voice sound +/ voice sound-: increase/reducethe volume

④ TF card slot: from the opening insert TF Card

⑤SIM card slot: using SIM Card

⑥Charging interface: charging the tablet via DC adapter

⑦Micro USB 3.0 interface：data transmission by inserting the micro USB 3.0 interface device

⑧HDMI interface: High-Definition multimedia interface

⑨Earphone Jack: outputs the audio signal to a loudspeaker or headset

⑩Front camera: taking photos and videos

⑪Indication LED: boot / charge indication

⑫Light sensor：Perception of external pipeline strength, electrical signal to CPU

⑬MIC：Recording sensor

⑭Speaker: built-in speaker, so you can hear the sound without external equipment

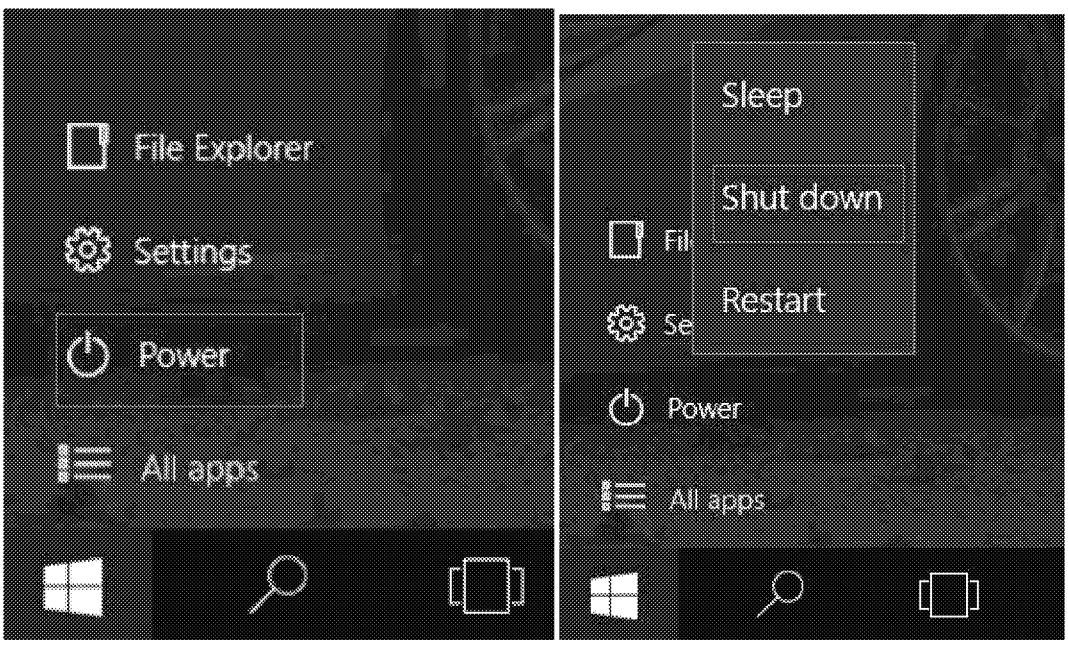
⑮Rear camera: taking photos and videos

- **Power On**

Press and hold the power button for 1~2 seconds to turn on the device

- **Power off (shut down) / sleep / restart**

Click on the windows symbol on the left bottom corner of the screen. Touch the power button, select & touch Sleep / Shut down / Restart.



Also you can press and hold the power button for about 2~6seconds till the screen slide to "Shut down your PC" appears and then use the touchpad to slide down the screen.

In Shut Down mode, no data will be saved and the tablet will boot to the operation system's main screen the next time it is turned on. If you have entered data, either save it to the internal storage or to the other storage media.

- **Connecting to a WiFi network**

Make sure that you are in a wifi zone.

1, Click on the arrow on the lower right corner and select the wifi icon.

1, select the name of the network you want to connect to, tap on "Connect" and enter a password if required.

Tip:

-To get the correct WiFi password (or settings) for the network, contact the WiFi network provider.

-If you want to connect to this network every time when it's in range, select the "Connect automatically" check box.

Chapter IV - Get familiar to Windows

- **Initial setup**

The first time you start up your device, the Windows Startup screen will be the first screen displayed. Follow the on-screen instructions on each screen in order to properly use the operation system. We recommend you create a Microsoft account, so you can enjoy more features.

Tip: If the tablet is used by more than one person, it is recommended to creat an user account for each person. Every user can set its default parameters to his needs.

Microsoft account

A Microsoft account is an email address and password that you use to sign into Windows. It is free an deasy to set up, and you can do with any email address you choose, or get a new email address (for example, you can use an outlook.com, Gmail, or Yahoo address for your Microsoft account). With a microsoft account, you can:

- Get apps from the Windows Store
- Link your social networking accounts to the people app, and you will see your friend's contact info and status updates in one place.

For detailed information about how to use Windows 10, please visit:
http://windows.microsoft.com/en-us/getstarted-get-to-know-windows-10

- **Start screen tiles customization**

Pinning icons: use the touchpad and the touch pad buttons to select the icon you want to move from your apps list to the start screen.

Moving icons: if you want to move an icon, use the touch pad and the touch pad buttons to select the icon and drag it to where you want to and drop it.

More options for icons: use the touchpad and the right touchpad button to click a tile and show options.

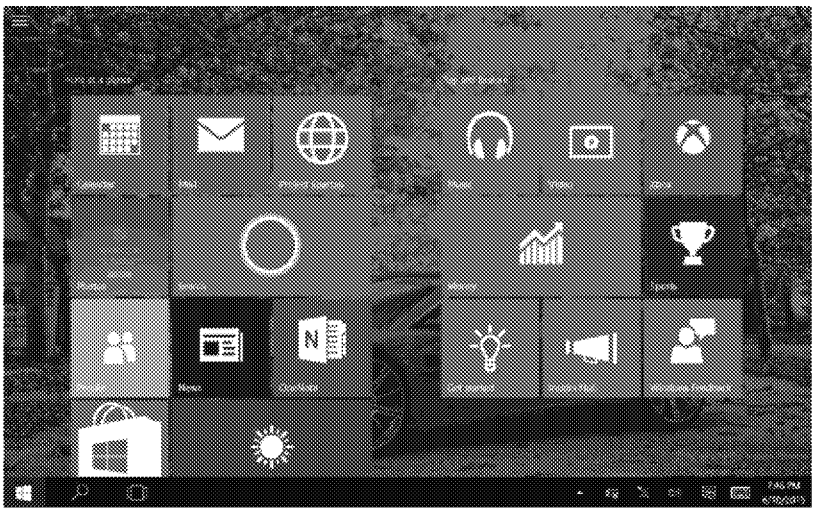
- **The Windows 10 Interface**

Windows 10 start image

On the start screen, you can see programs fixed in the image.

These application programs are displayed in the form of magnet. When you click the them, you can easily visit them.

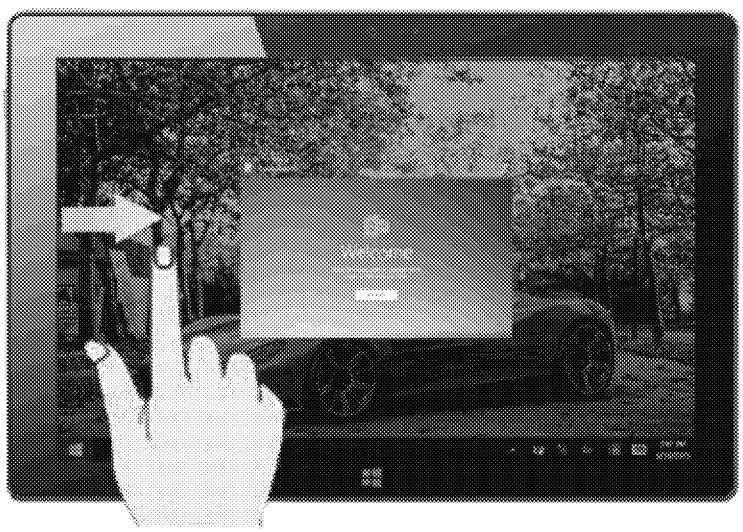
You need to log on your Microsoft Microsoft account before the application program completely runs.



Screen slide applications

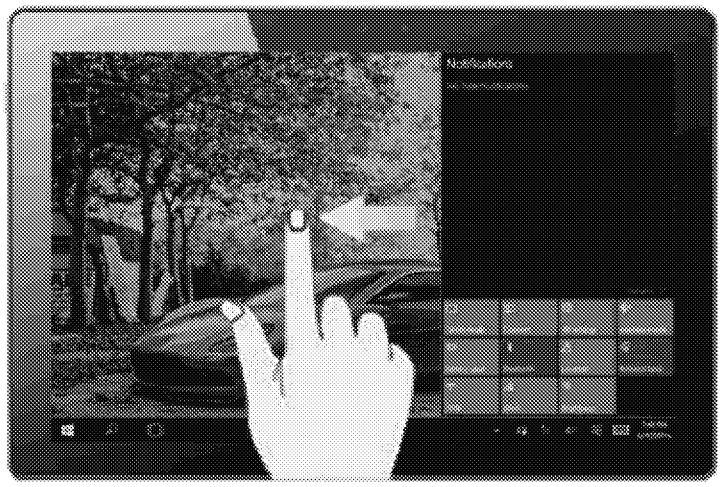
Slide to right

Slide from the left edge of the screen to the right to open the running programs.



Slide to left

Slide from the right edge of the screen to left to enter tablet setting panel.



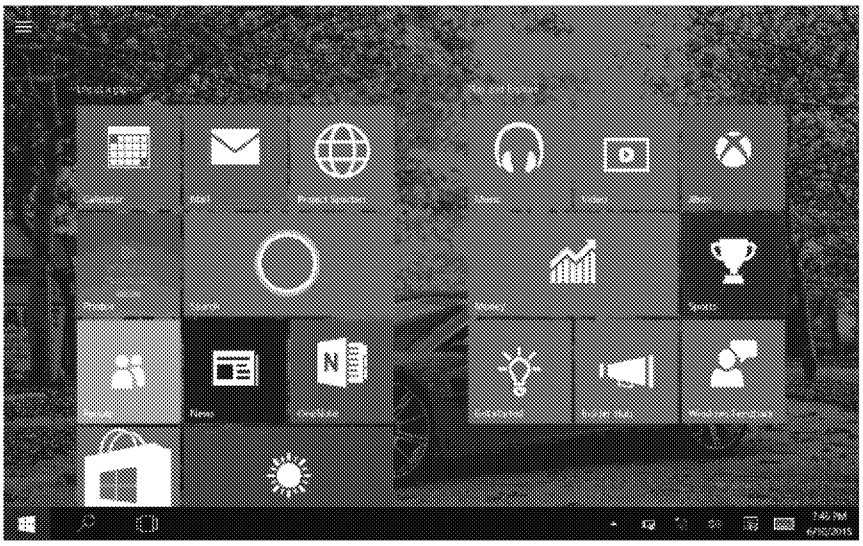
Slide downward

In start screen, slide from the top of the screen to view all application programs.

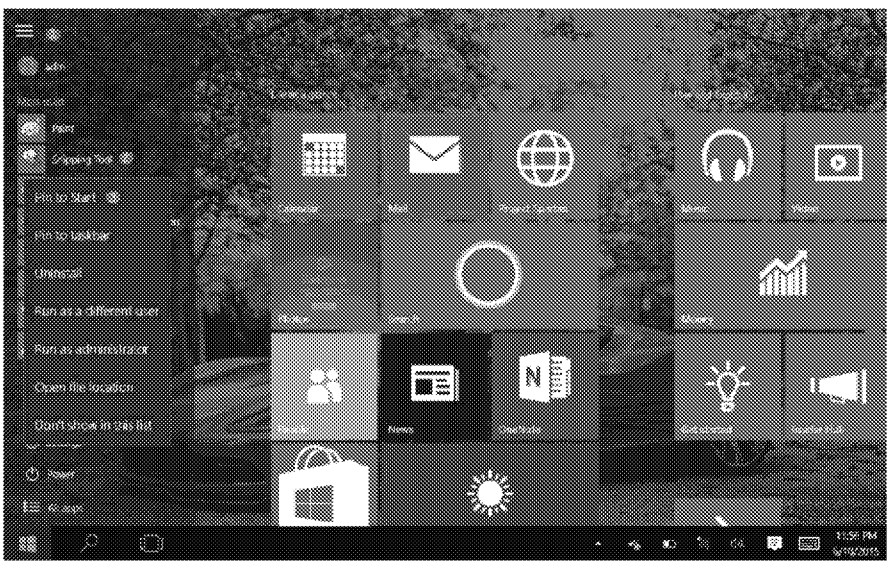
Side with finger

In start screen, slide finger up and down to move the image.

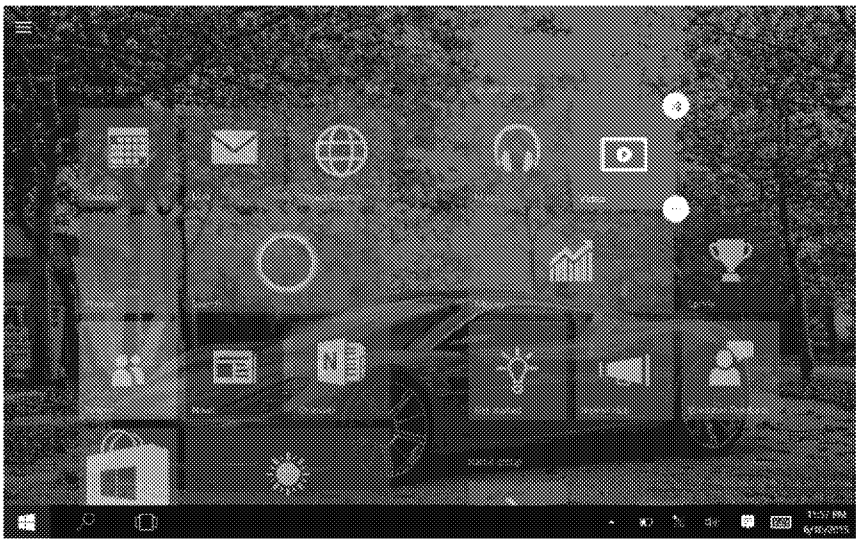
Except for the application programs which are already fixed on the start screen, you can also start other programs in “All apps”.



If you want to fix more application programs on the start interface, following the steps in the picture below, (1) click the properties icon; (2)press and hold the application program magnet for about one second and then let go (3) click the pin to start.

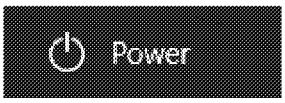


Conversely, if want to cancel or delete a certain application in start screen, (1) lightly touch and hold the application program magnet for about one second, then release. Select the icon in the red box (indicated in the picture).



Charm menu colume

In PC mode, touch start button to start Charm menu colum, including: get started, device, set up, share, and search program etc.

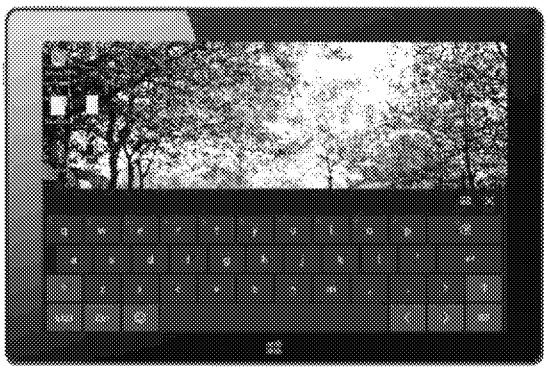


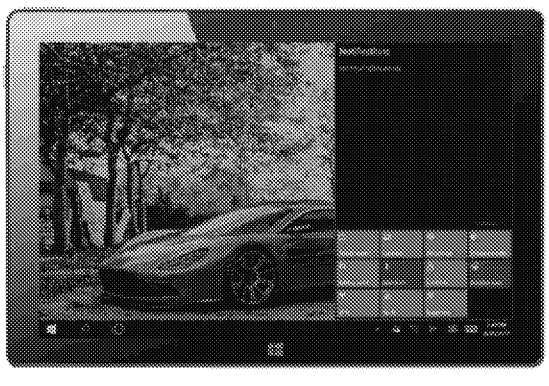
--Sleep / shut down /restart the tablet.

-- Search files and application programs in the tablet

-- Make settings to the tablet

-- For more apps

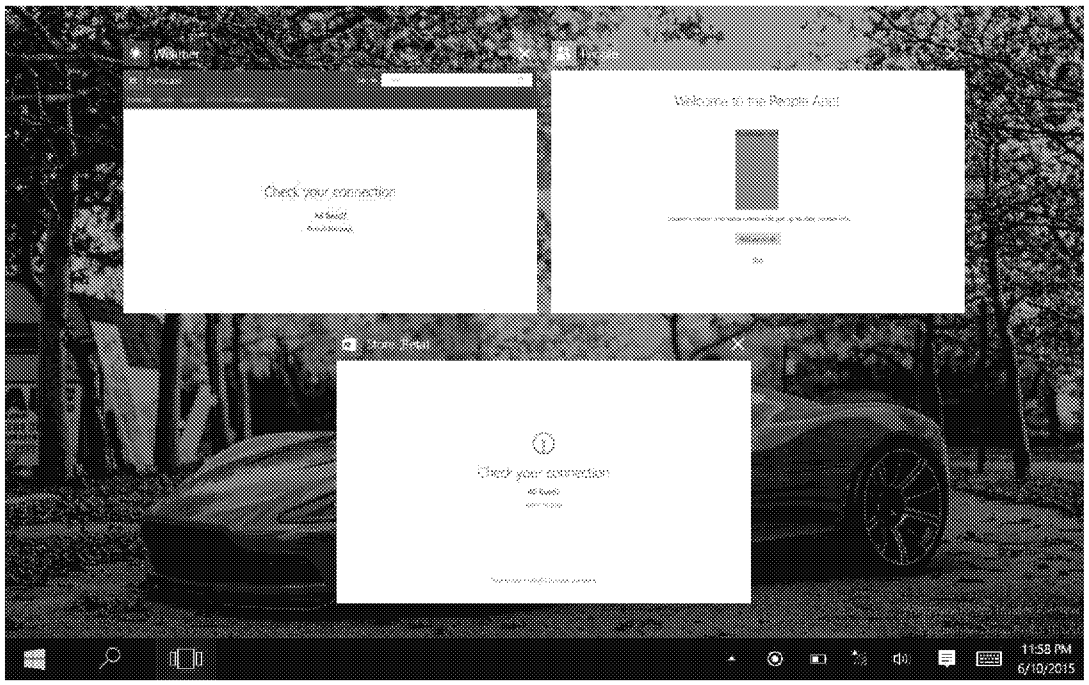

--Search menu


--Device menu


-- Setup menu

Multitasking operating interface

Slide from left of the screen to right, you will see the programs in running. You can enter the program or delete the program.



Windows notification center

Click the icon in lower right corner of the screen to display the notification center.

1 – To change from PC mode to tablet mode

2 – To turn on/off the screen rotation

3 – To take notes

4 – To access all settings

5 – To connect other devices

6 – To manage the device's battery

7 – To make a VPN connection

8 – To turn on/off the Bluetooth connection

9 – To adjust the screen brightness

10 – To turn on/off the WiFi connection

11 – To turn on/off the Quiet hours option

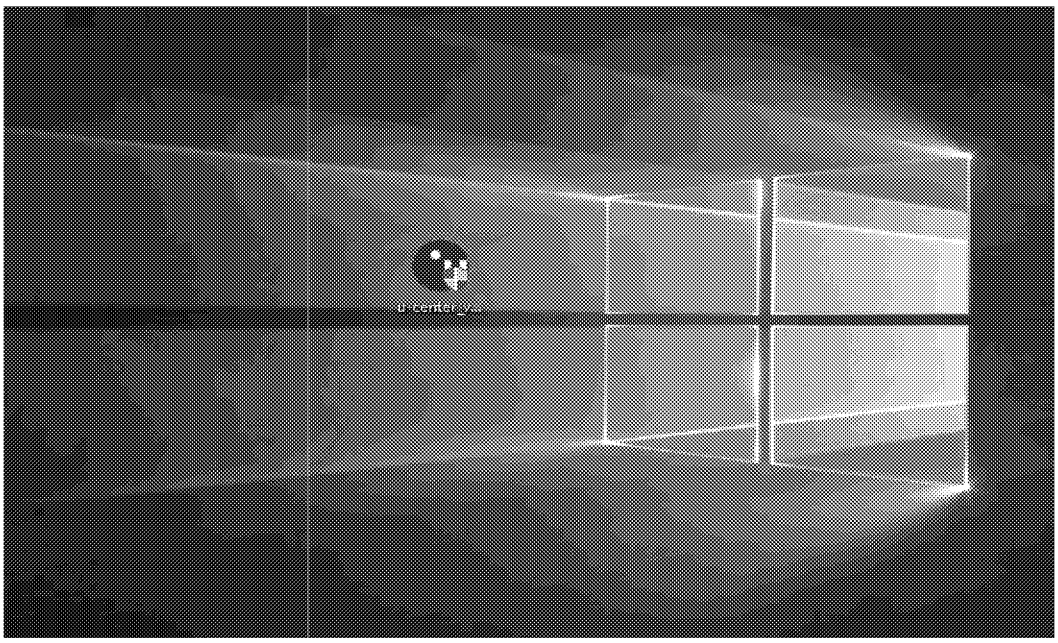
12 – To turn on/off location services

13 – To turn on/off the flight mode

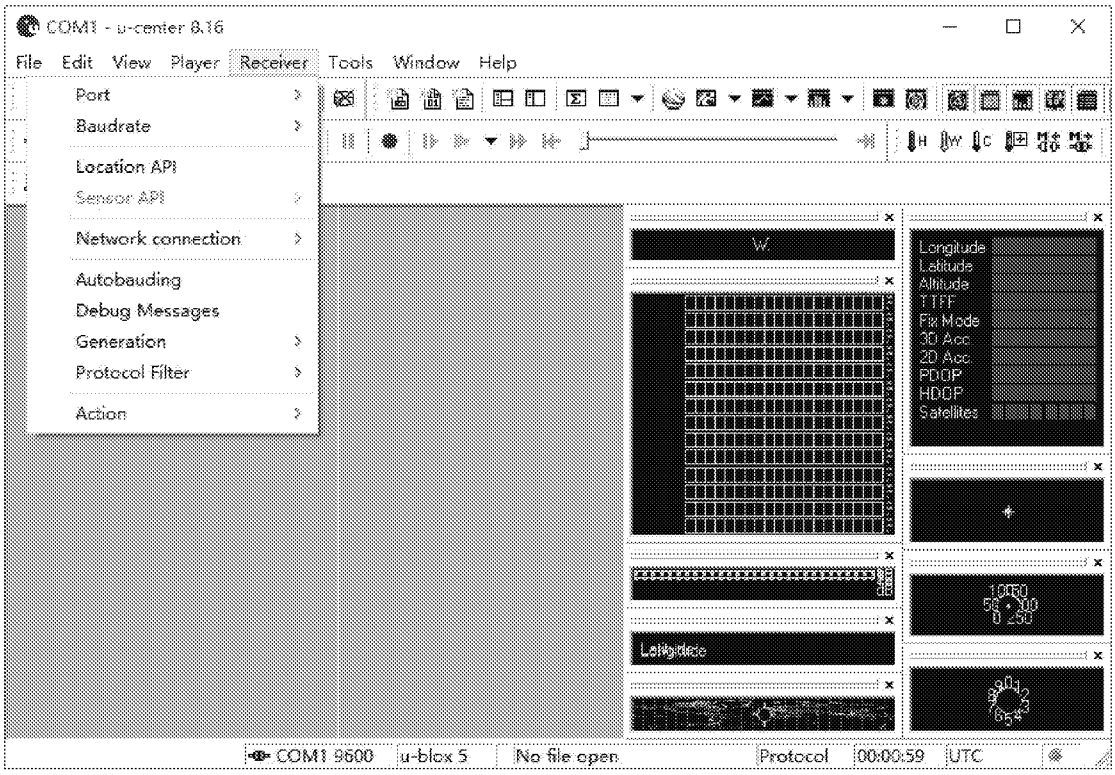
Chapter V Special Function Module

U-blox GPS

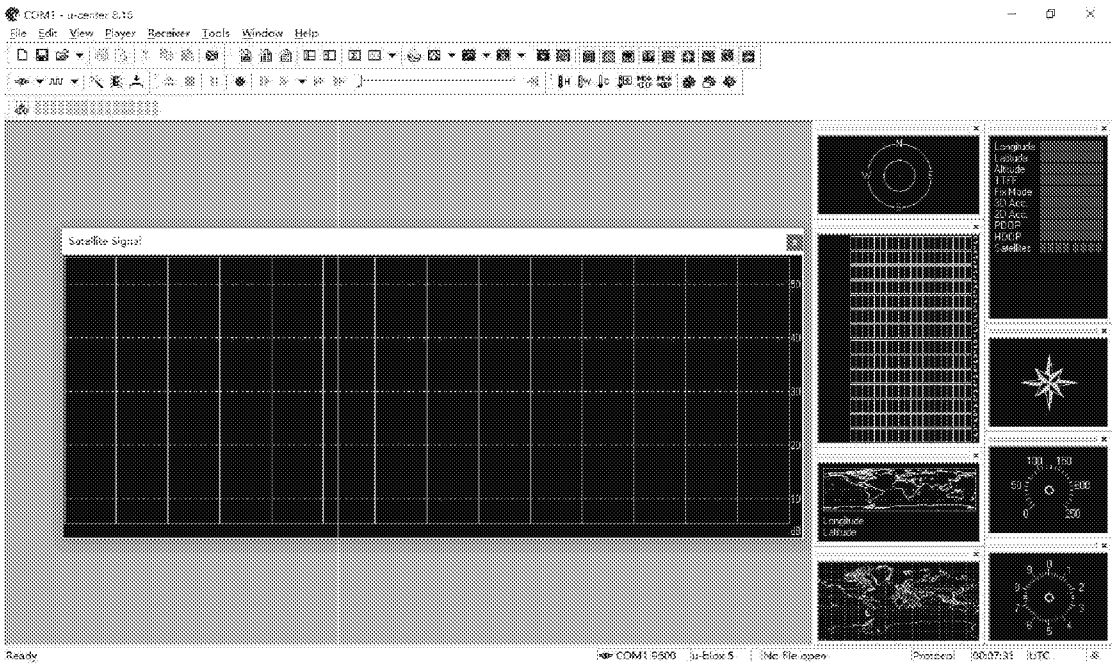
Copy u-blox test tool to desktop.



Open the software, click Receiver => Port => COM1.
Also set Baudrate as 9600.

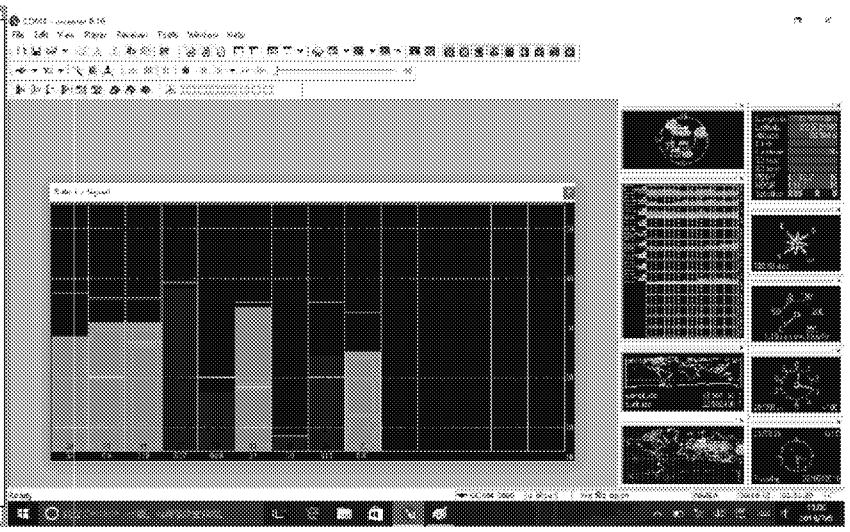


Double click the satellites model picture to enlarge.

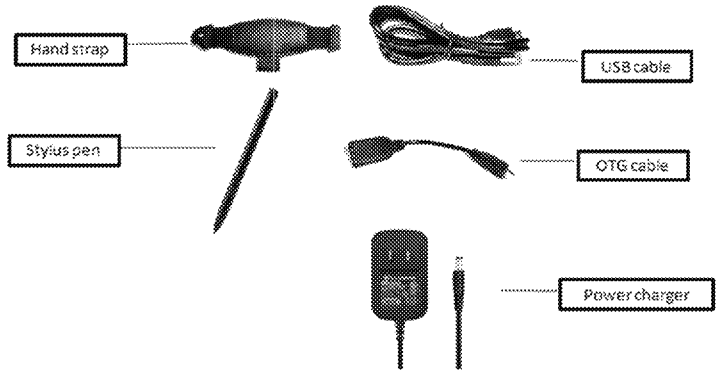


The blue colors are the satellites that searched, green color are effective satellites. The numbers in the right are signal value.

Standard:
Environment: in open field, no metal in around, no obstacles. Sunny weather, no clouds covering.
Condition: cansee satellites above 12 pieces, effective satellites above 10 pieces. Have2-3pieces satellites value reach to above 40 dB.



Chapter VI – Accessories



Remarks: the stylus pen is optional.

ATTACHMENT C

Field Data Collection Instructions

The following Instructions cover the essential technologies and workflow necessary for field data collection and processing for the Hunters Point Naval Shipyard Split Sampling event. The various hardware and software are explained in detail in the following document.

Tablet

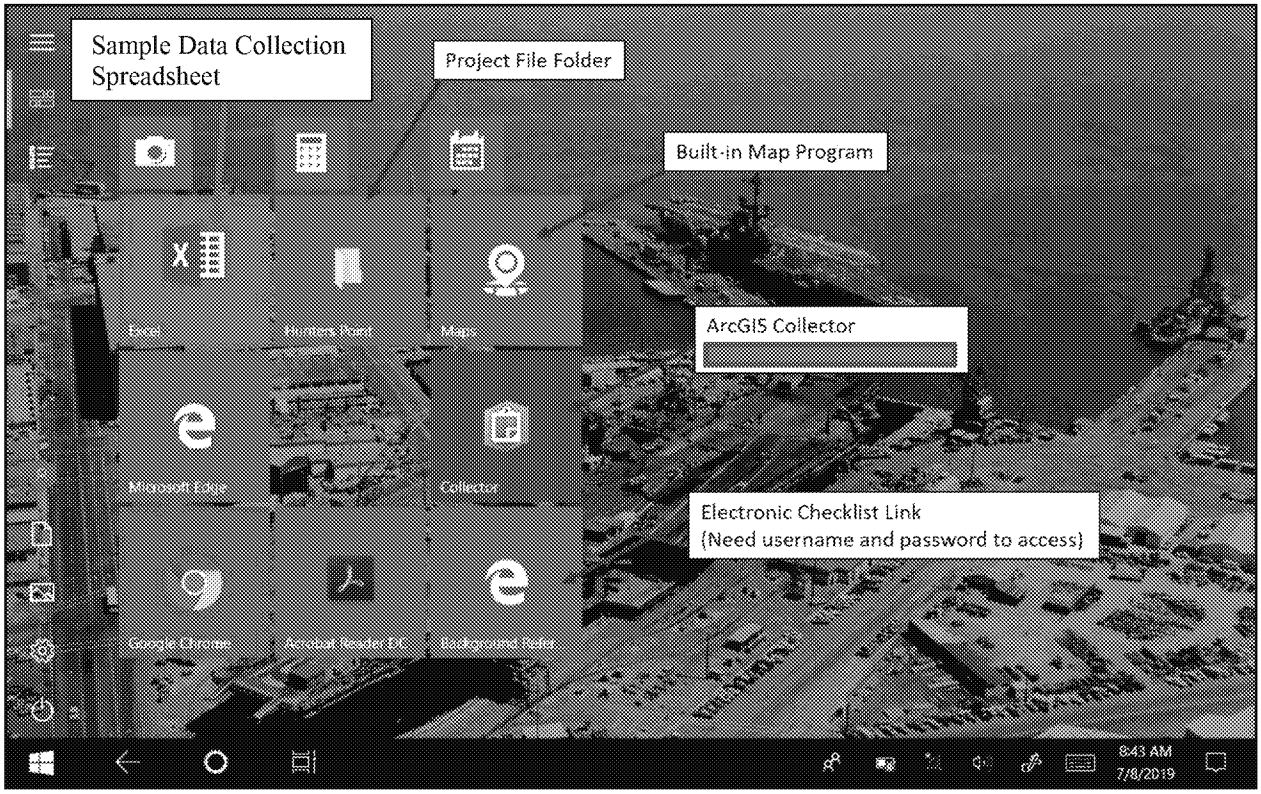
Excel Spreadsheet of the Sampling Data Collection

Field Oversight Checklist for Background Reference Area Scanning and Sampling

Tablet

Field Split Sampling operations will involve the use of a Tablet device to document and store all field data collection. Below is an outline of the field-specific operation, function, and configuration of the Field Data Collection Tablet. For a more detailed description of the Tablet, see the official Manual "Tablet Quick Start Guide".

To access the Tablet, press the "On" button and enter the password "Techl@w". This will bring up the front page, as seen here:



The operating system is Windows 10, with most of the options, functions, and locations seen on the desktop version. Take a moment to familiarize yourself with the various buttons and functions. The Tablet home screen has been configured to display the most relevant and important applications, such as the Camera, Calculator, Calendar, Web Browsers, Adobe PDF Reader, Maps, Excel, and other project-specific materials. The Hunters Point Project File Folder contains all documents for the project. This is where the Electronic Checklist (Field Oversight Checklist for Background Reference Area Scanning and Sampling) forms will be stored. It also contains an Excel Spreadsheet of the Sampling Data Collection.

Excel Spreadsheet of the Sampling Data Collection

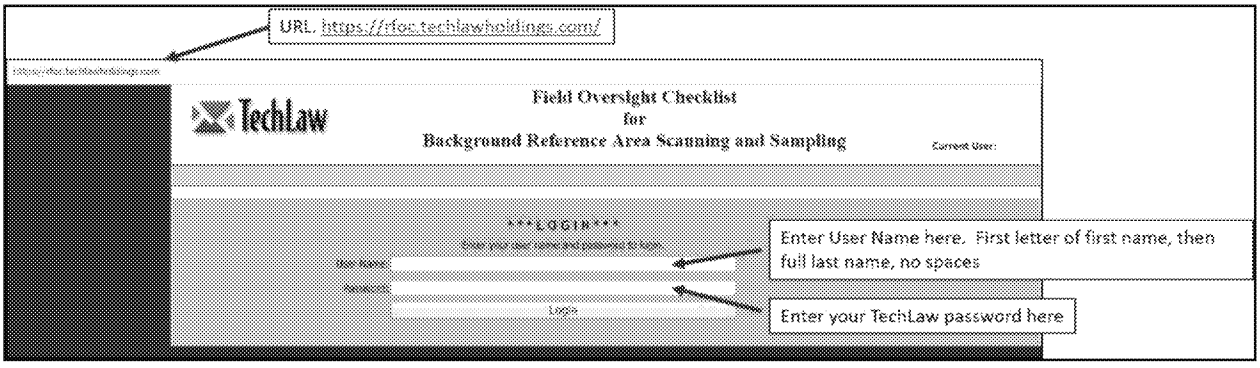
The actual Soil Sampling data—such as Sample ID, Sampler, Depth, etc.—will be manually logged into an Excel Spreadsheet on the tablet. It will then all be saved, able to be accessed and downloaded later. The spreadsheet can be used, updated and edited offline or online with the WiFi.

The following is an example of the Sampling Data Collection Spreadsheet:

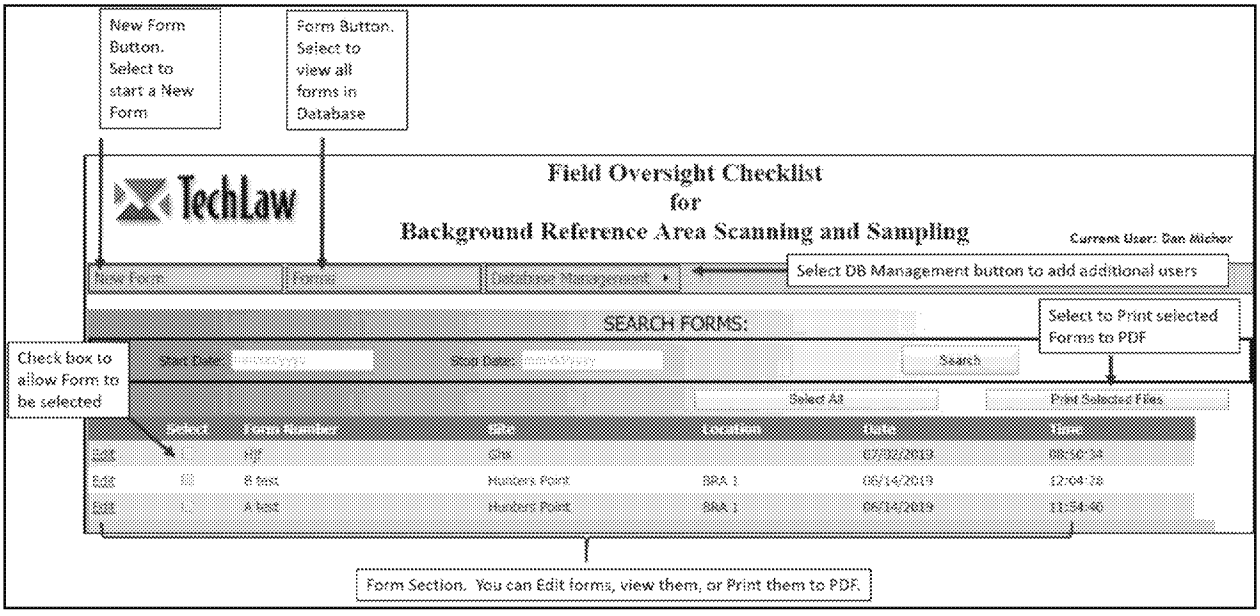
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	SiteName	StationName	FieldSampleID	SampleMatrix	GammaScan	SampleTop	SampleBottom	DepthUnits	Sampler	SampleDate	SampleTime	NavySampleID	Notes	Latitude	Longitude
2	Hunters Point Naval Shipyard	RBA1-01	RBA1-01	Soil											
3	Hunters Point Naval Shipyard	RBA1-02	RBA1-02	Soil											
4	Hunters Point Naval Shipyard	RBA1-03	RBA1-03	Soil											
5	Hunters Point Naval Shipyard	RBA1-04	RBA1-04	Soil											
6	Hunters Point Naval Shipyard	RBA1-05	RBA1-05	Soil											
7	Hunters Point Naval Shipyard	RBA2-01	RBA2-01	Soil											
8	Hunters Point Naval Shipyard	RBA2-02	RBA2-02	Soil											
9	Hunters Point Naval Shipyard	RBA2-03	RBA2-03	Soil											
10	Hunters Point Naval Shipyard	RBA2-04	RBA2-04	Soil											
11	Hunters Point Naval Shipyard	RBA2-05	RBA2-05	Soil											
12	Hunters Point Naval Shipyard	RBA3-01	RBA3-01	Soil											
13	Hunters Point Naval Shipyard	RBA3-02	RBA3-02	Soil											
14	Hunters Point Naval Shipyard	RBA3-03	RBA3-03	Soil											
15	Hunters Point Naval Shipyard	RBA3-04	RBA3-04	Soil											
16	Hunters Point Naval Shipyard	RBA3-05	RBA3-05	Soil											
17	Hunters Point Naval Shipyard	RBA4-01	RBA4-01	Soil											
18	Hunters Point Naval Shipyard	RBA4-02	RBA4-02	Soil											
19	Hunters Point Naval Shipyard	RBA4-03	RBA4-03	Soil											
20	Hunters Point Naval Shipyard	RBA4-04	RBA4-04	Soil											
21	Hunters Point Naval Shipyard	RBA4-05	RBA4-05	Soil											
22	Hunters Point Naval Shipyard	RBA-SB-01	RBA-SB-01	Soil											
23	Hunters Point Naval Shipyard	RBA-SB-02	RBA-SB-02	Soil											
24	Hunters Point Naval Shipyard	RBA-SB-03	RBA-SB-03	Soil											
25	Hunters Point Naval Shipyard	RBA-SB-04	RBA-SB-04	Soil											
26	Hunters Point Naval Shipyard	RBA-SB-05	RBA-SB-05	Soil											
27	Hunters Point Naval Shipyard	RBA-SB-06	RBA-SB-06	Soil											
28	Hunters Point Naval Shipyard	RBA-SB-07	RBA-SB-07	Soil											
29	Hunters Point Naval Shipyard	RBA-SB-08	RBA-SB-08	Soil											
30	Hunters Point Naval Shipyard	RBA-SB-09	RBA-SB-09	Soil											
31	Hunters Point Naval Shipyard	RBA-SB-10	RBA-SB-10	Soil											
32															
33															

Field Oversight Checklist for Background Reference Area Scanning and Sampling

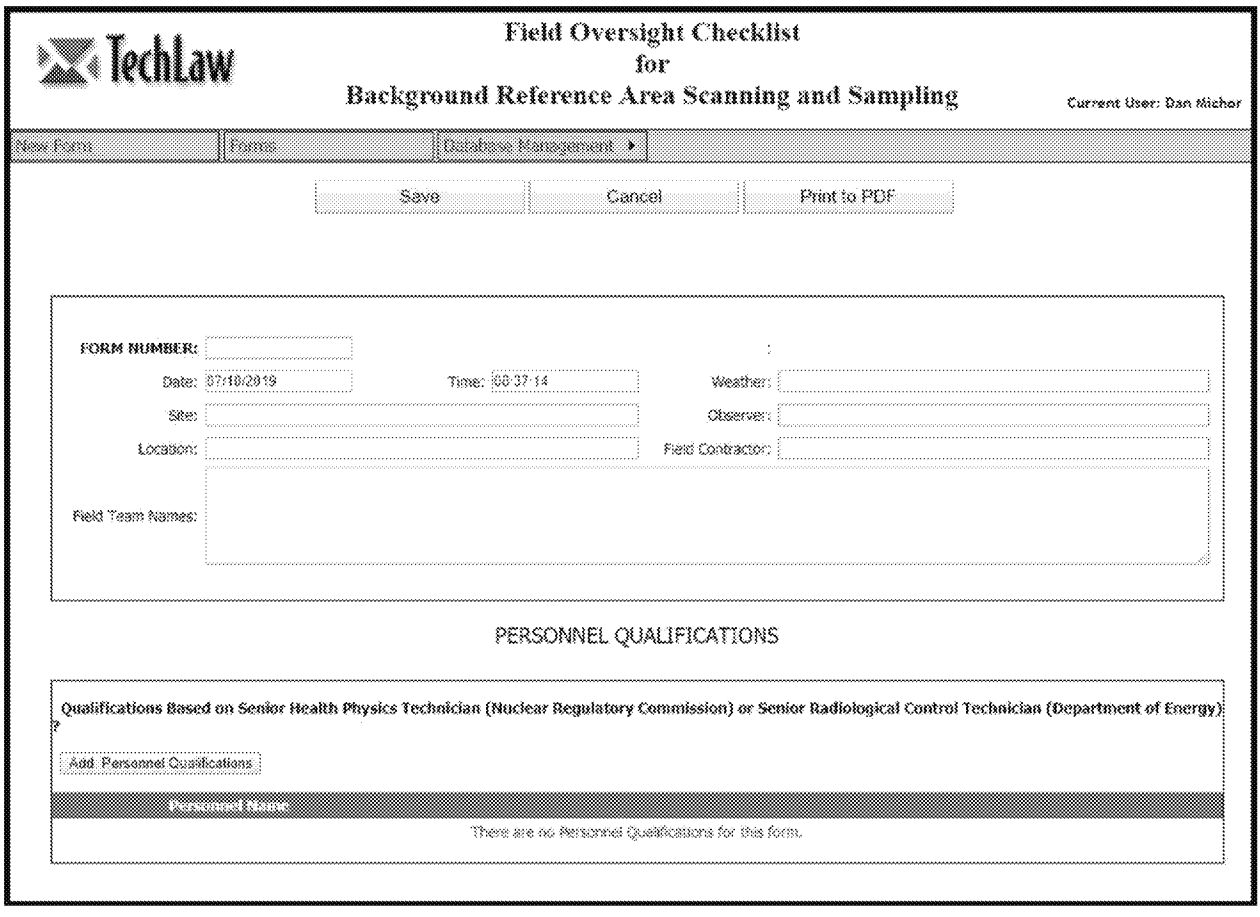
The Field Oversight Checklist for Background Reference Area Scanning and Sampling is an electronic form that can only be accessed Online. Once your Tablet is connected to a wireless network, the Checklist can be accessed with one click on the home screen by selecting the appropriate icon. When you click that icon, the following screen will appear.



Enter your User Name and Password to access the Checklist form. This will display the following screen.



You can access existing forms already filled out here, or you can start a new form. When you select "New Form", the following screen will appear.

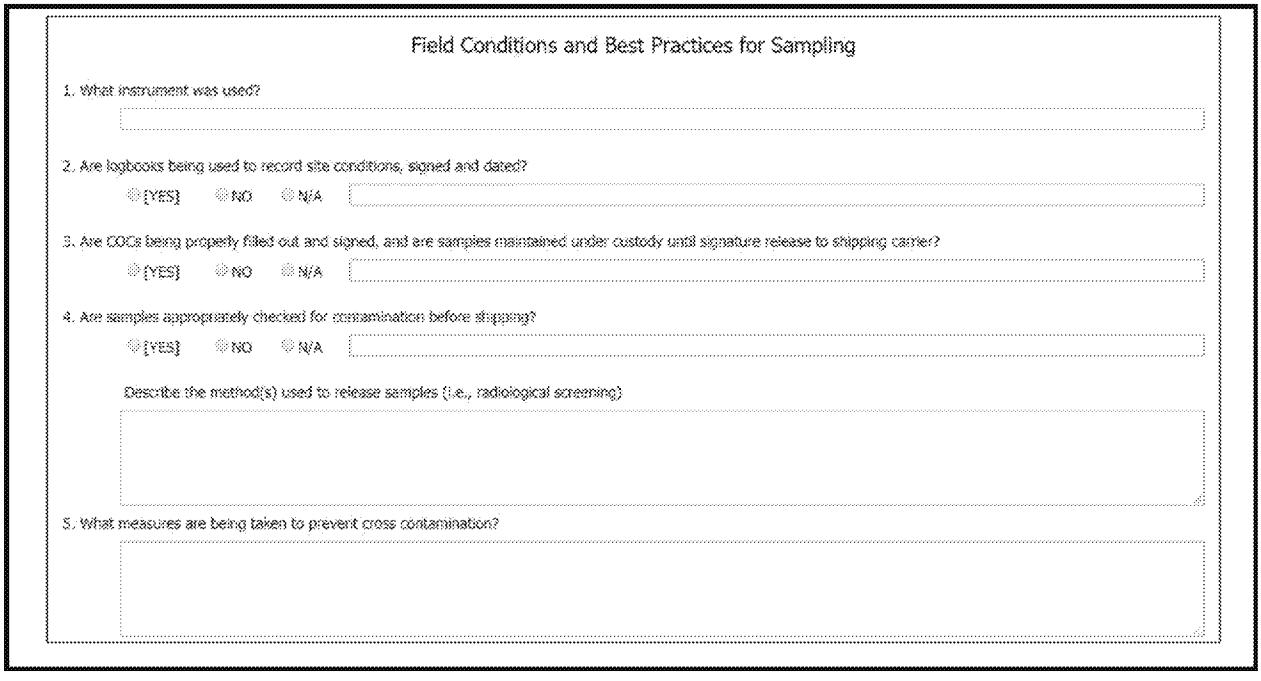


The form is designed to be intuitive and simple. Each selection should be able to be filled out in the field as you go along. Take a moment to familiarize yourself with the options available throughout the form. Under the section PERSONNEL QUALIFICATIONS, you can select the button "Add Personnel Qualifications" to access a series of questions related to personnel onsite. Below is a screenshot of that portion of the form.

As you move throughout the entire form, you will find the following sections:

Field Conditions and Best Practices for Sampling
Gamma Scanning Instrument Checks
Operation
Soil Sampling
Additional Comments/Observations

Field Conditions and Best Practice for Sampling



Field Conditions and Best Practices for Sampling

1. What instrument was used?

2. Are logbooks being used to record site conditions, signed and dated?

[YES] NO N/A

3. Are COCs being properly filled out and signed, and are samples maintained under custody until signature release to shipping carrier?

[YES] NO N/A

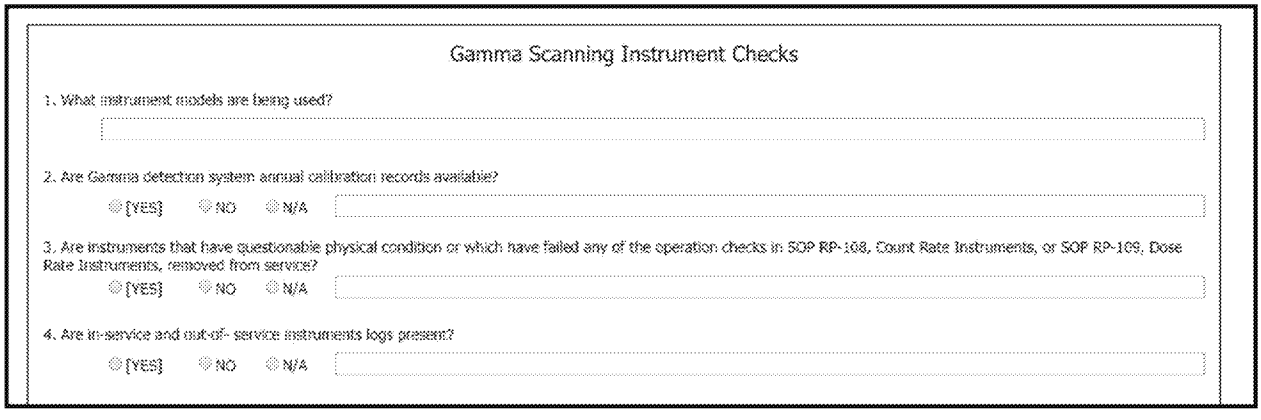
4. Are samples appropriately checked for contamination before shipping?

[YES] NO N/A

Describe the method(s) used to release samples (i.e., radiological screening)

5. What measures are being taken to prevent cross contamination?

Gamma Scanning Instrument Checks



Gamma Scanning Instrument Checks

1. What instrument models are being used?

2. Are Gamma detection system annual calibration records available?

[YES] NO N/A

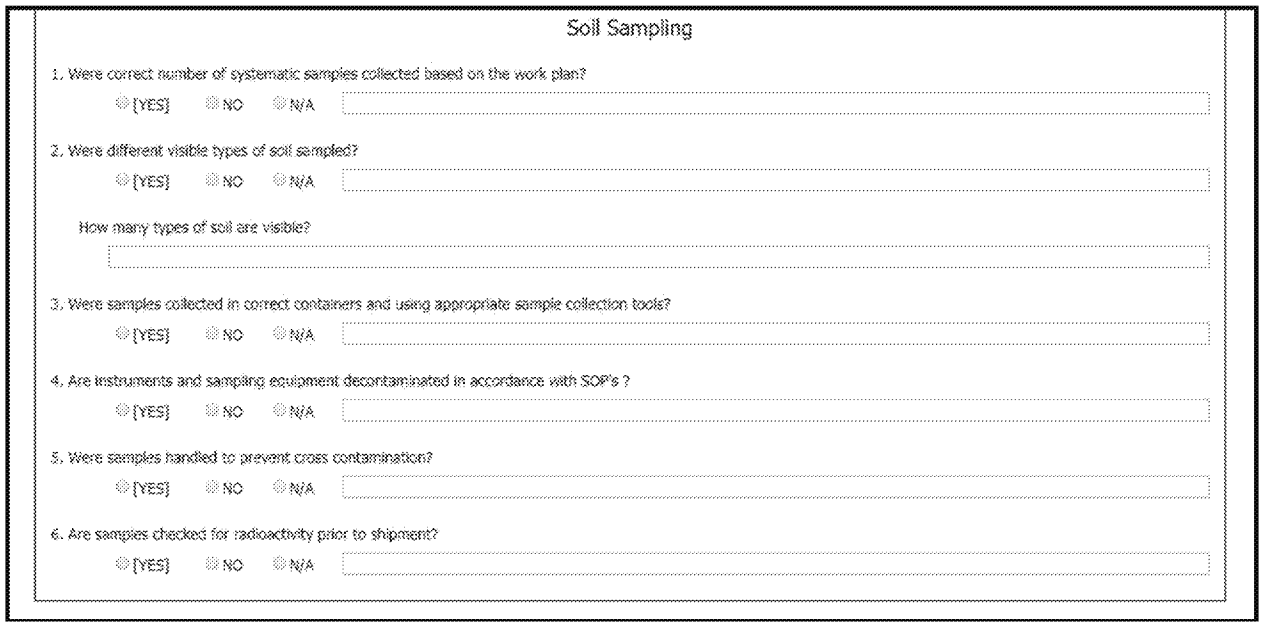
3. Are instruments that have questionable physical condition or which have failed any of the operation checks in SOP RP-108, Count Rate Instruments, or SOP RP-109, Dose Rate Instruments, removed from service?

[YES] NO N/A

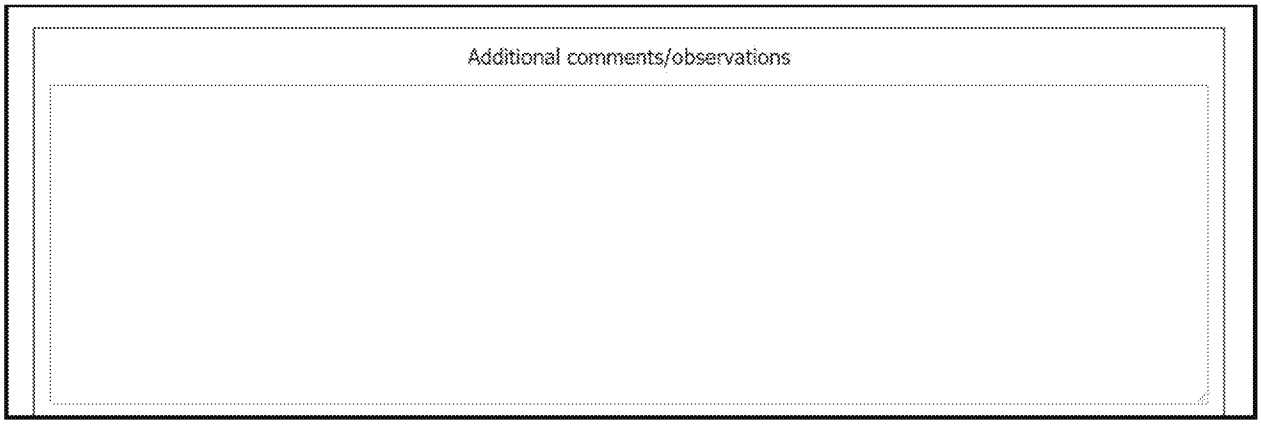
4. Are in-service and out-of- service instruments logs present?

[YES] NO N/A

Soil Sampling



Additional Comments/Observations



The Form automatically auto saves and is stored online. Any form can be selected and printed to PDF at any time. From there you can save it as a PDF or print it.

ATTACHMENT D

Navy Split Sampling Procedure

Split Sampling: Radiological Background Soil Sampling, Former Hunters Point Naval Shipyard, San Francisco, California, June 2019

This document presents the general methodology and field activities for the radiological background soil sampling at the Former Hunters Point Naval Shipyard (HPNS) in San Francisco, California to inform the United States Environmental Protection Agency's (USEPA), or other regulatory agencies, plan to replicate the gamma walkover survey and collect split samples from approximately 10 percent of the locations. This document is based on and a supplement to the Parcel G Removal Site Evaluation Work Plan (Soil Reference Background Area Work Plan is included as Appendix C and the Sampling and Analysis Plan (SAP) is included as Appendix B) (June 2019). This document is not all-inclusive and only intended to provide guidance on the approach for the gamma walkover survey and soil sampling activities as related to regulatory oversight.

The objective of the radiological background soil sampling is to establish representative background soil data sets for comparison and evaluation of soil data collected from HPNS. The reference background area (RBA) data collected will support a final decision on whether residual radioactivity is found to exceed the remediation goals at HPNS. The primary field activities are to:

- Complete a gamma walkover survey to confirm the areas are viable background locations.
- If viable background locations, collect representative surface and subsurface soil samples from four onsite RBAs (**Figure 3-1**) located in Parcel B (RBA-1), Parcel C (RBA-2), Parcel D-1 (RBA-3), Parcel D-2 (RBA-4) and the offsite RBA location.

The project duration is expected to include approximately 2 weeks of soil sampling. In general, work days will be Monday through Friday from 0700 to 1700 (work day limited to 12 hours door to door).

The following sections provide general information on pre-mobilization activities, the gamma walkover survey, soil sampling, access, and contacts.

Pre-Mobilization

Prior to the field activities described herein, a subsurface utility clearance and land survey to define the project areas will be conducted. Additionally, a pre-mobilization kick-off meeting will be held with USEPA and other regulatory agencies as needed, to discuss logistics and schedule.

Gamma Walkover Survey

The objective of the reference background area scanning is to identify anomalous radiological conditions that may affect an area's use as a reference area. Following the completion of the site preparation activities, 100 percent of the accessible surface (i.e., ground level surface) of each RBA will be scan surveyed.

The gamma scan survey will be performed using Perma-Fix's Eagle iScan survey systems. For this project, the Eagle iScan will consist of a Ludlum Model 44-20 (3 inch by 3 inch [3x3] NaI detector), listed in Table 3-3 in Appendix C of the Parcel G Removal Site Evaluation Work Plan, coupled to a DigiBase (photo multiplier tube and multichannel analyzer) with automated data logging using MAESTRO Multichannel Analyzer Emulation Software. Both gross gamma and gamma spectral measurements will be collected simultaneously during the gamma scan along with a date and time stamp. In addition to automated radiological data collection, the position of the detector will be logged using a global positioning system (GPS). The MAESTRO software and GPS data will be managed using a personal computer or tablet.

Each 3x3 detector and DigiBase system are calibrated using NIST traceable sources. For this project, the detector systems were calibrated using a ^{137}Cs, ^{60}Co, and a mixed gamma source that includes ^{40}K and ^{208}Tl. Calibration certificates are attached to this document.

Upon mobilization, the Eagle iScan systems will undergo an initial instrument set-up as required by Perma-Fix procedure RP-104 (included in Appendix D of the Parcel G Removal Site Evaluation Work Plan). Prior to use each day, at midday, and at the end of the day, each system will undergo an operational check, consisting of an alignment check, background count, and source response check (SRC). Perma-Fix is anticipating using ^{137}Cs and ^{60}Co check sources to perform the required periodic alignment and SRCs during the RBA characterization field work. Qualitative Quality Control (QC) measurements can be performed using the check sources to determine relative detector response characteristics between Eagle iScan system detectors and regulator detectors.

The scan survey will be performed as a walkover survey, following a NUREG-1575 protocol. Each 3x3 iScan system will be held by the surveyor during scanning with a consistent height of about 4 inches above the ground surface and traveling in straight lines (terrain permitting) at a rate of approximately 0.5 meters per second (m/s) in approximately 1-meter wide swaths.

The gamma spectra will be evaluated using region of interest (ROI)-peak identification tool capabilities in the MASESTRO software for the radionuclides of concern (ROCs) that correspond to gamma rays at 186 kiloelectron volts (keV) for ^{226}Ra, 609 keV for ^{226}Ra daughter ^{214}Bi, 662 keV for ^{137}Cs, and other gamma emissions associated with the uranium and thorium decay series. In addition, gross gamma energy windows may be used to identify radiological anomalies that are not readily identified with a single gamma energy, such as the bremsstrahlung radiation from a deck marker containing ^{90}Sr.

Following the scan survey, the number of data points and the percent coverage (from a plot of the data) will be reviewed in accordance with Appendix C, Section 4.1, of the Parcel G Removal Site Evaluation Work Plan, to ensure that the design parameters of the gamma scan survey were satisfied and identify if elevated scan measurements are present. If elevated scan measurements are observed, follow-up investigations will be performed with static gamma measurements to delineate and characterize potential areas of interest.

The Eagle iScan systems will be used to assess gamma scan investigation locations using a 1-minute or greater static count and spectral analysis to compare the activity at a specific point to background. For gamma scan investigations, the net spectrum will be plotted and the critical levels assessed for ROC-specific energy ranges to find out if there is activity present above background. Critical levels, as defined in the MARSSIM Section 6.7.1, represent thresholds above which net counts are statistically greater than background (USEPA et al., 2000). Site-specific gamma scan investigation levels (ILs) for site ROC and gross gamma (i.e., full-energy spectrum) measurements will be determined following mobilization and the collection of site-specific background data.

Areas with elevated scan measurements that are attributed to contamination or discrete radiological objects will not be sampled, and alternate locations will be selected.

Soil Sampling

The objective of the radiological background soil sampling is to establish representative background soil data sets for comparison and evaluation of soil data collected from HPNS. Following the completion of the gamma walkover survey and confirmation that the areas are viable background locations, soil sampling will commence.

Offsite Surface and Subsurface Soil and Onsite Surface Soil

Surface and subsurface soil samples will be collected from an offsite RBA. **Figure 3-3** show the approximate sampling grids and vertical depiction. Soil samples will be collected at 25 locations within

the 0 to 6 inch, 6 to 12 inch, 12 to 18 inch, and 18 to 24 inch depth intervals, resulting in 100 soil samples.

Surface soil samples will be collected from four onsite RBAs located in Parcel B (RBA-1), Parcel C (RBA-2), Parcel D-1 (RBA-3), and Parcel D-2 (RBA-4). **Figure 3-3** and **Figures 3-4** through **3-7** show the approximate sampling grids and vertical depiction. The soil samples will be collected within the 0 to 6 inch depth intervals at 25 locations at each RBA, resulting in 100 soil samples.

Generally, the soil samples will be collected as follows:

- For the purposes of this investigation, surface soil is defined as the uppermost 6-inch interval of native soil, and for onsite locations, beneath the asphalt and road base materials installed as part of the durable cover.
- Soil samples will be collected via a clean shovel, hand auger, or other tool. After removing the soil core from the ground, the soil core will be scanned and transferred directly into a clean stainless steel bowl for mixing.
- The soils removed from the sample location will be visually described using United Soil Classification System (USCS) ASTM standards. The sample will be identified as surface soil and the approximate volume of the extracted soil will be included. Color, moisture, texture, and coarse clast composition (i.e., serpentine, shale, sandstone, chert, gabbro) will be identified.
- Split samples will be available to USEPA or other regulatory agencies to take for independent analysis real-time during field activities. Locations for split samples will be flexible to allow for sufficient volume for Navy samples and Quality Assurance (QA)/QC samples.
- A representative sample will be prepared for laboratory analysis. The sample for radiological analyses will be mixed in the field by breaking the sample into small pieces and removing overburden gravel and biological material (equivalent to approximately 3.5 to 4-mesh sieve size). Mixing by hand will be conducted until there is consistency in texture and color. The entire mixed sample, or aliquot thereof, will be placed in the designated laboratory sample container. For field duplicate samples (1 for every 10 field samples collected) or split samples, an alternate spooning technique will be used to split the soil between the primary sample container and the field duplicate or split sample container.
- A minimum of 500 grams of soil are required to complete radiological analyses. If the sample is also selected as a field duplicate or split sample, a minimum of 1,000 grams of soil are required. If sample size requirements are not met by a single sample collection, additional sample volume may be obtained by collecting a sample from adjacent to the original sample location within the core and compositing the sample.
- Excess soil material that was not sampled will be returned to the hole from which it came or will be spread adjacent to the sample location.

Onsite Subsurface Soil

Subsurface soil samples will be collected from four onsite RBAs located in Parcel B (RBA-1), Parcel C (RBA-2), Parcel D-1 (RBA-3), and Parcel D-2 (RBA-4). **Figure 3-3** and **Figures 3-4** through **3-7** show the approximate sampling grids and vertical depiction. Soil samples will be collected at 5 locations within each RBA at 5 depth intervals (1- to 2-foot below ground surface [bgs], 3- to 4-foot bgs, 5- to 6-foot bgs, 7- to 8-foot bgs, and 9- to 10-foot bgs), resulting in 25 subsurface soil samples at each RBA and a total of 100 subsurface soil samples.

Subsurface soil samples will be collected using drilling-rig-mounted equipment to collect samples. Hand clearance of soil boring locations to a depth of 5 ft bgs may be required with hand auger where

information on subsurface utilities is uncertain. Generally, drilling and retrieving the boring using the thin-walled tube method will be as follows:

- Using a drilling rig, a hole is advanced to the desired depth. The samples are then collected following the ASTM D 1587 standard (thin-walled tube method) or ASTM D 1586 standard (split-spoon method).
- Upon removal of the sampler from the ground, the tube/core is carefully cut/split open to maintain the material in the tube. The soil tube/core will be turned over to the project geologist and radiation technician for sample preparation, radiological surveys, and containerization.

Soil tubes/cores will be processed within the background areas. Once the soil tube/core has been cut/split open, soil examination and sample collection will occur as follows:

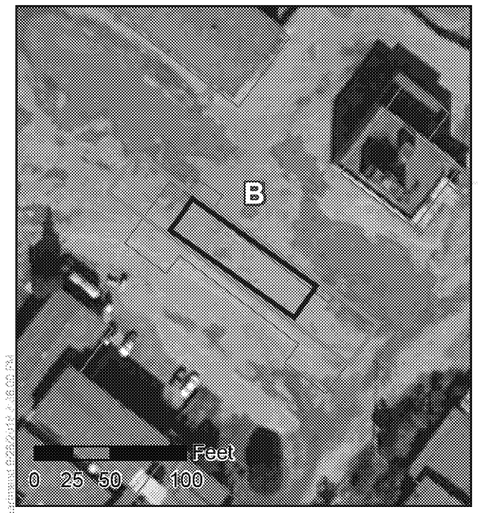
- The soils removed from the sample location will be visually described using USCS ASTM standards. The sample will be identified as surface soil and the approximate volume of the extracted soil will be included. Color, moisture, texture, and coarse clast composition (i.e., serpentine, shale, sandstone, chert, gabbro) will be identified.
- Split samples will be available to USEPA or other regulatory agencies to take for independent analysis real-time during field activities. Locations for split samples will be flexible to allow for sufficient volume for Navy samples and QA/QC samples.
- A representative sample will be prepared for laboratory analysis. The sample for radiological analyses will be mixed in the field by breaking the sample into small pieces and removing overburden gravel and biological material. (equivalent to approximately 3.5 to 4-mesh sieve size). Mixing by hand will be conducted until there is consistency in texture and color. The entire mixed sample, or aliquot thereof, will be placed in the designated laboratory sample container. For field duplicate samples (1 for every 10 field samples collected) or split samples, an alternate spooning technique will be used to split the soil between the primary sample container and the field duplicate or split sample container.
- A minimum of 500 grams of soil are required to complete radiological analyses. If the sample is also selected as a field duplicate or split sample, a minimum of 1,000 grams of soil are required. If sample size requirements are not met by a single sample collection, additional sample volume may be obtained by collecting a sample from adjacent to the original sample location within the core and compositing the sample.
- Excess soil material that was not sampled will be returned to the hole from which it came or will be spread adjacent to the sample location.

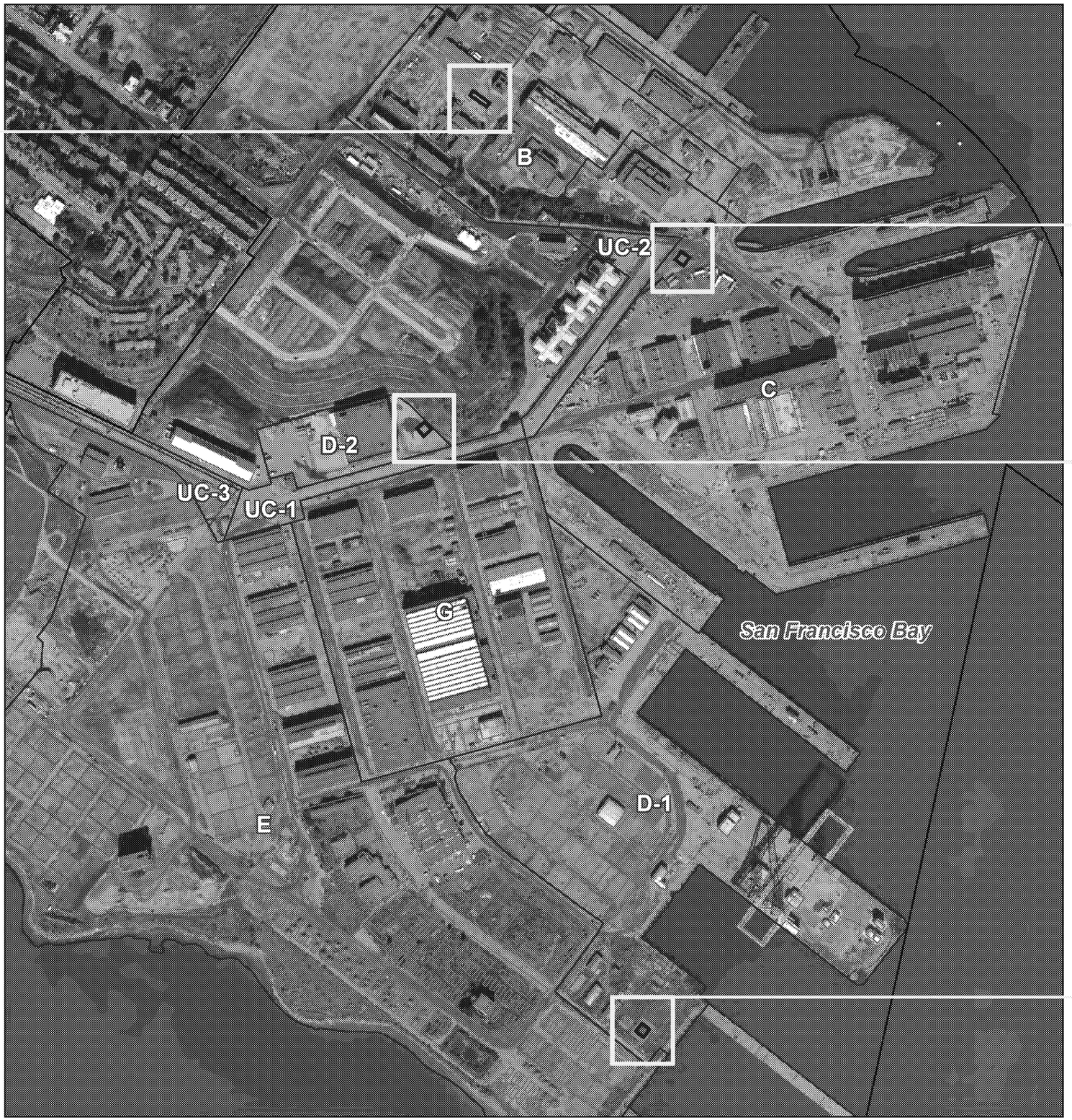
Access

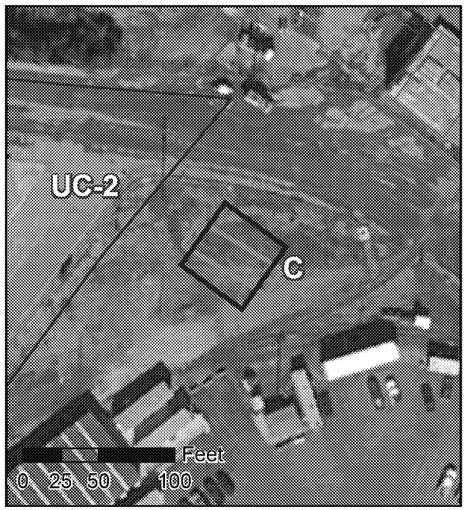
RBA-1 through RBA-4 and project trailer:
Crisp Road Entrance
Former Hunters Point Naval Shipyard
50 Crisp Road
San Francisco, CA 94134

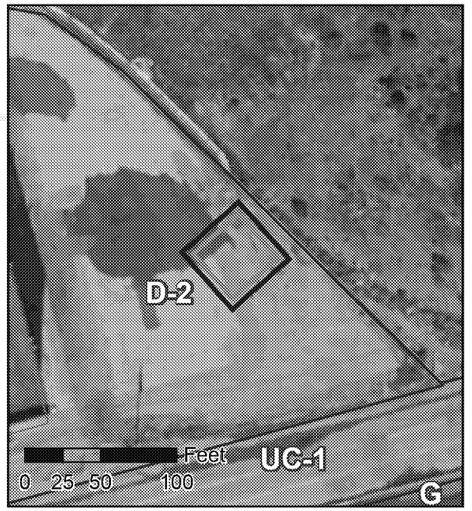
Contact Information

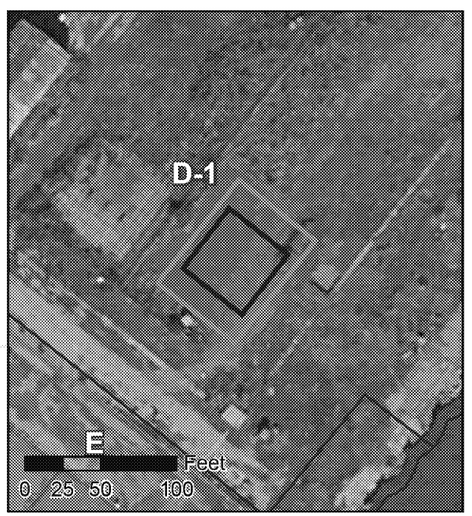
Organization and Role	Contact Information
NAVFAC BRAC Remedial Project Manager	Paul Stoick Office: 619-524-6041
CH2M Project Manager	Kim Henderson Office: 619-272-7209 Cell: 757-513-6632











Legend:

- Reference Background Area
- Historical Reference Background Area
- Installation Boundary
- Parcel Boundary
- Current and Former Building Site

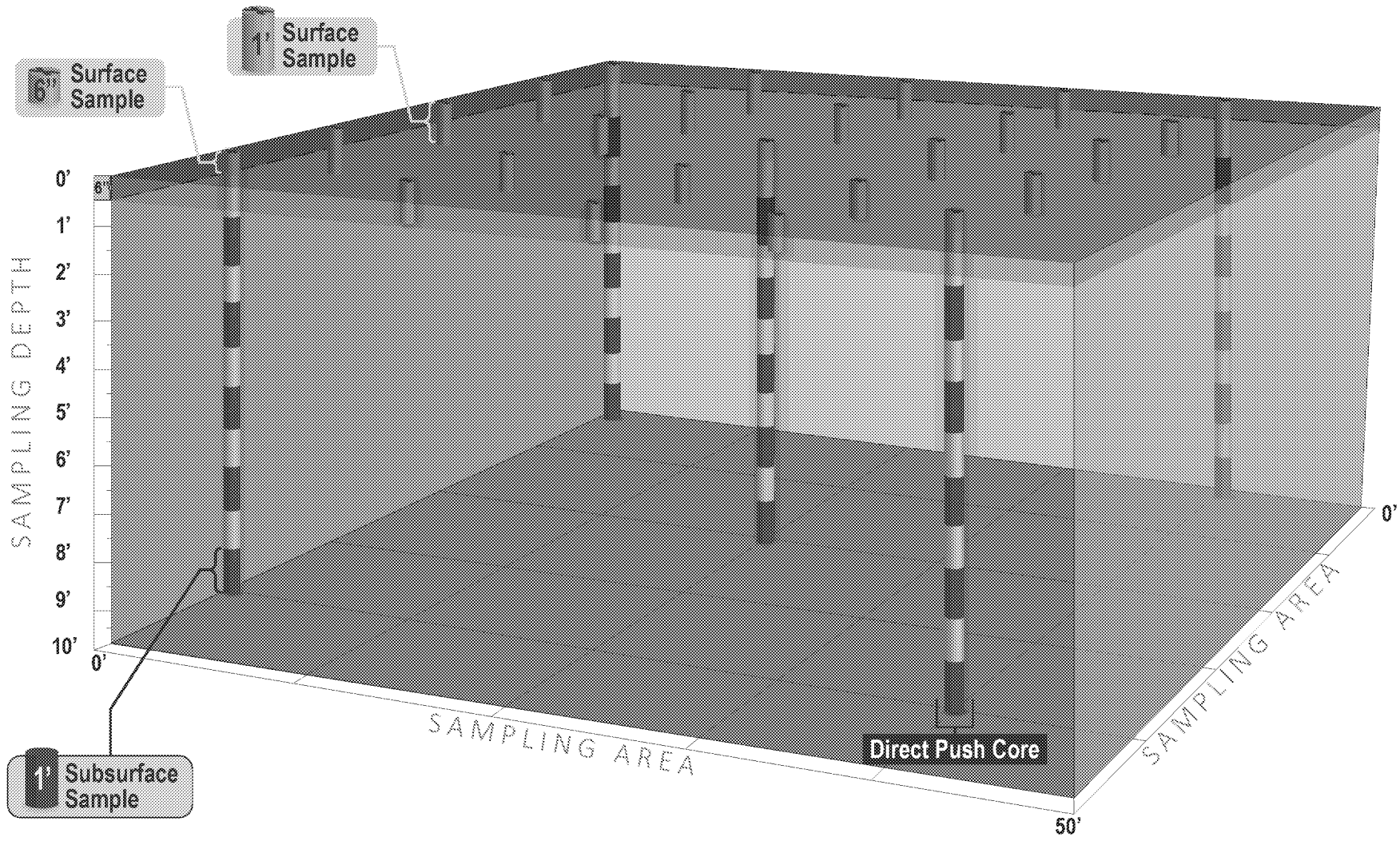
N

Feet
0 250 500 1,000

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 3-1
HPNS Reference Background Areas
Soil Reference Background Area Work Plan
Former Hunters Point Naval Shipyard
San Francisco, California

Onsite RBA



Offsite RBA

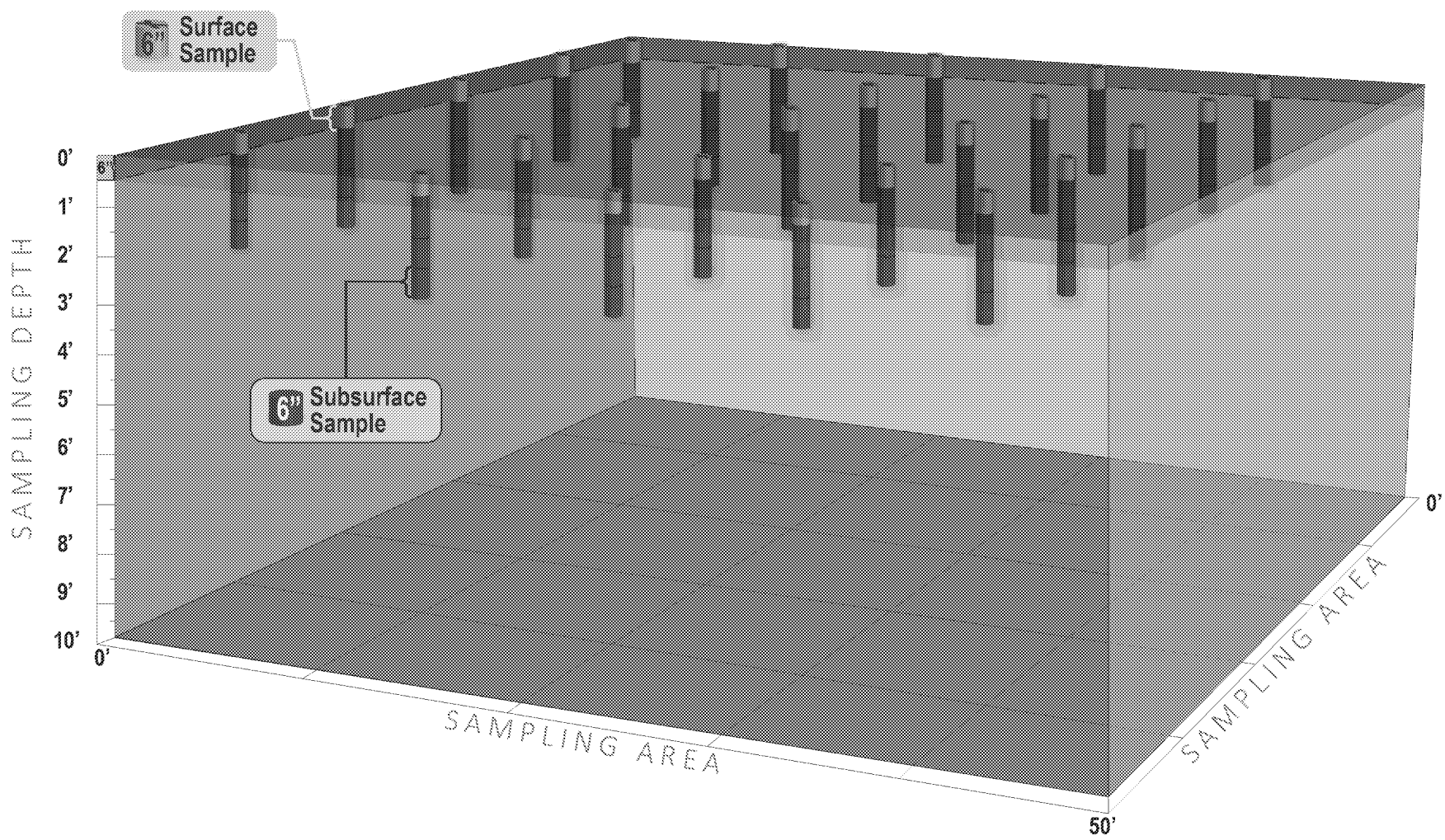
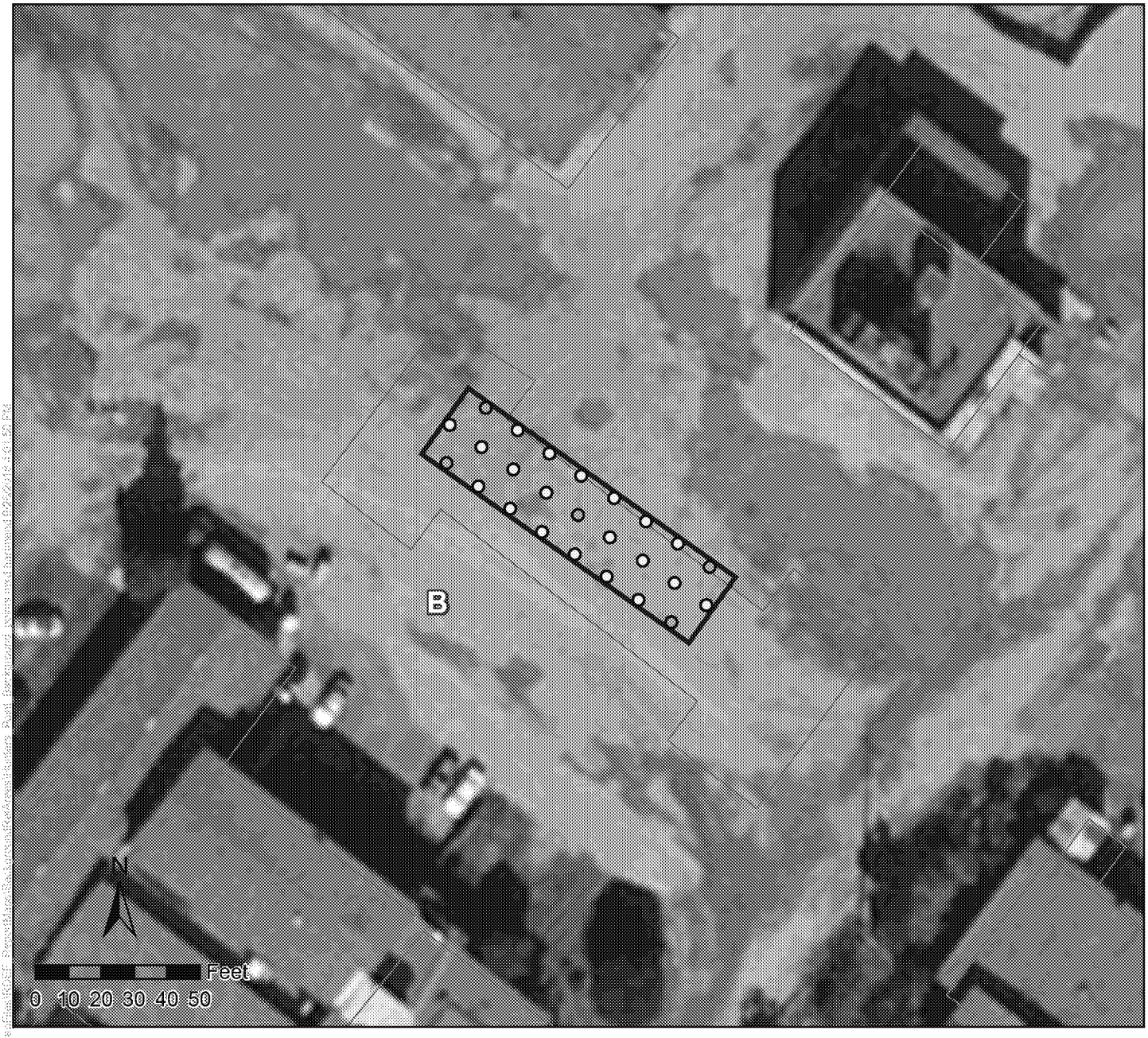
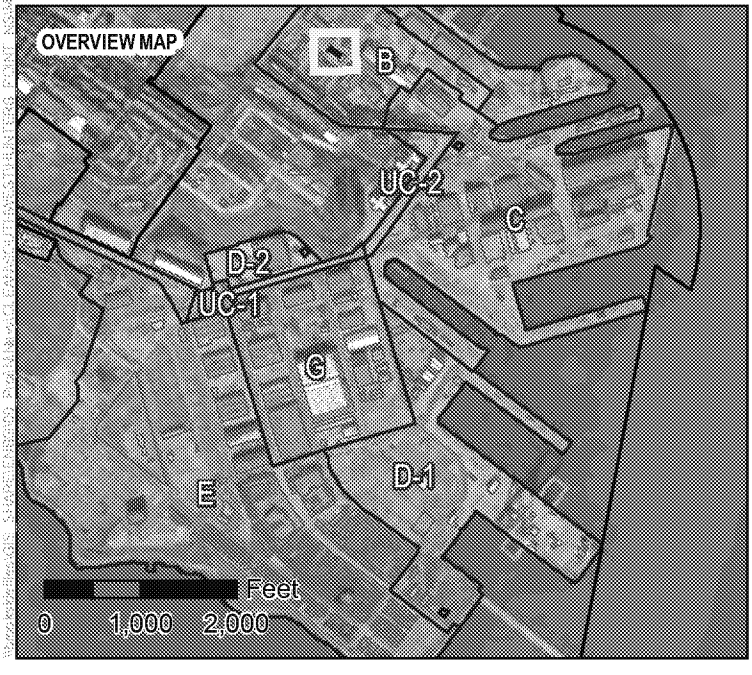


Figure 3-3
Example Surface and Subsurface Sample Locations
Hunters Point Naval Shipyard
San Francisco, CA

JETT TBD





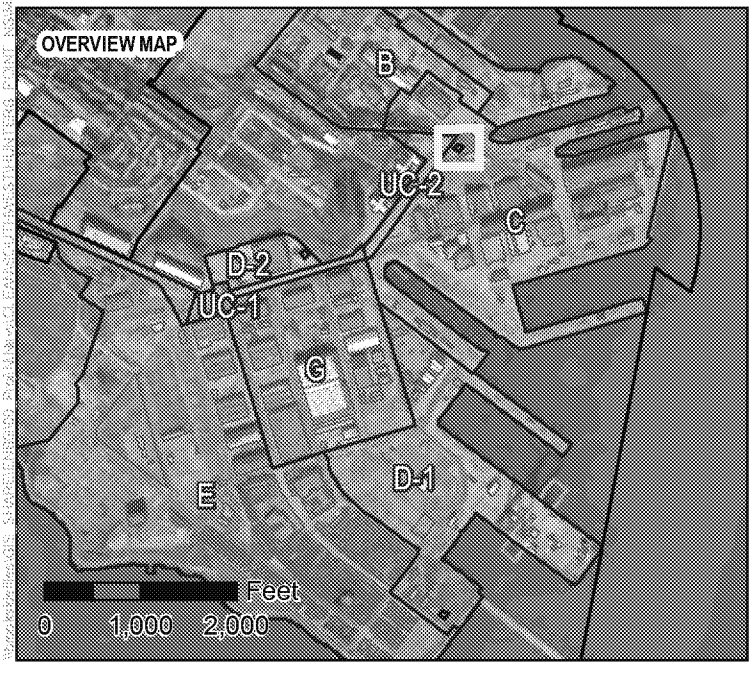
Legend:

- Surface Sample Location
- Surface and Subsurface Sample Location
- Reference Background Area
- Installation Boundary
- Parcel Boundary
- Current and Former Building Site

COORDINATE SYSTEM:
NAD 1983 StatePlane California III FIPS 0403 Feet

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 3-4
HPNS Reference Background Area RBA-1
Soil Reference Background Area Work Plan
Former Hunters Point Naval Shipyard
San Francisco, California



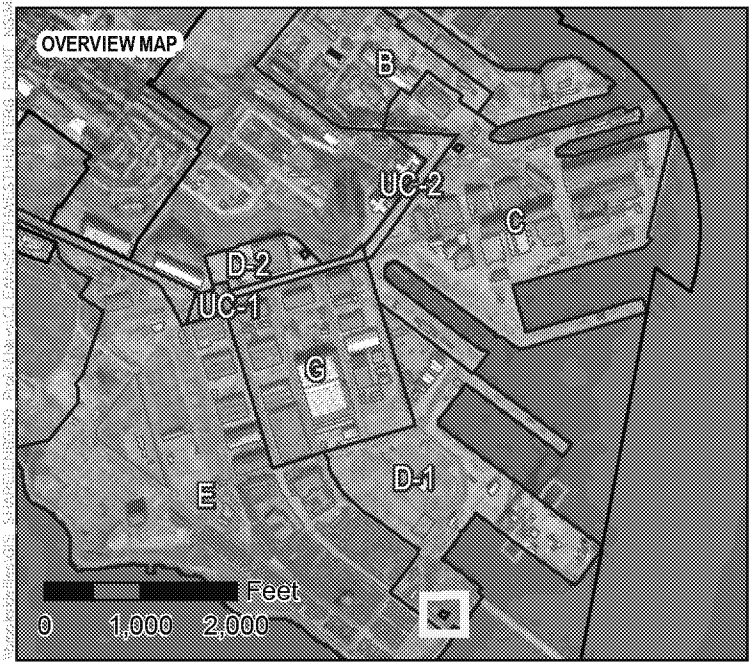
Legend:

- Surface Sample Location
- Surface and Subsurface Sample Location
- Reference Background Area
- Installation Boundary
- Parcel Boundary
- Current and Former Building Site

COORDINATE SYSTEM:
NAD 1983 StatePlane California III FIPS 0403 Feet

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 3-5
HPNS Reference Background Area RBA-2
Soil Reference Background Area Work Plan
Former Hunters Point Naval Shipyard
San Francisco, California



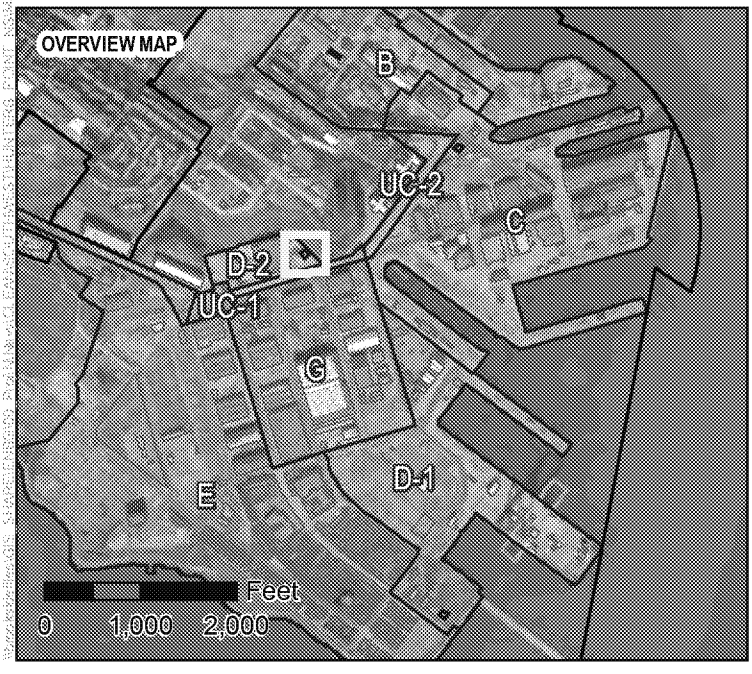
Legend:

- Surface Sample Location
- Surface and Subsurface Sample Location
- Reference Background Area
- Installation Boundary
- Parcel Boundary
- Current and Former Building Site

COORDINATE SYSTEM:
NAD 1983 StatePlane California III FIPS 0403 Feet

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 3-6
HPNS Reference Background Area RBA-3
Soil Reference Background Area Work Plan
Former Hunters Point Naval Shipyard
San Francisco, California



Legend:

- Surface Sample Location
- Surface and Subsurface Sample Location
- Reference Background Area
- Installation Boundary
- Parcel Boundary
- Current and Former Building Site

COORDINATE SYSTEM:
NAD 1983 StatePlane California III FIPS 0403 Feet

BASE MAP SOURCE:
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 3-7
HPNS Reference Background Area RBA-4
Soil Reference Background Area Work Plan
Former Hunters Point Naval Shipyard
San Francisco, California

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

DigiBase/NaI Calibration Sheet

Probe Model Number : 12/12/2003 **Customer Name :** Perma-Fix
Probe Serial Number : 121218N **Technician :** Jeff Knight
Date of Calibration : 11/9/2018

Instruments used during calibration					
Model Number:	DigiBase	Serial Number:	17164798	Calibration Due Date:	11/9/2019
Model Number:	44-20	Serial Number:	020218N	Calibration Due Date:	11/9/2019

NIST Traceable Source(s) used:

	Source S/N	Activity(s) µCi	Assay Date
Cs-137	CS-7A-2	7.0000	3/5/2018
MG	1105	1.0200	11/19/2002
Co-60	1105	0.1640	11/19/2002

MGB Properities

High Voltage Setting: 750

Amplifier Settings
Gain: 0.8450
Shaping Time: 0.75µS

ADC Settings:
Conversion Gain: 1024
Lower Level Disc: 10
Upper Level Disc: 1023

Zero Offset Adjustment -7000
Actual Zero Offset 1.538

(2.92 keV)

Target keV/Channel Data:			As Left keV/Channel Data:		
Isotope	keV	Channel	Isotope	keV	Channel
Cs-137:	661.66	226.21	Cs-137:	661.66	227
Co-60:	1173.2	401.51	Co-60:	1173.2	404
Co-60:	1332.5	456.02	Co-60:	1332.5	458
K-40:	1461	500	K-40:	1461	N/A
Tl-208:	2614	894.6	Tl-208:	2614	N/A

Calibration sticker attached? Yes

Comments :

Initial Calibration of Alpha Spectra 3x3 probe (44-20) married to ORTEC DIGIBASE #17164798

Date instrument is due for next calibration : 11/9/2019

Performed by : _____ Reviewed by : _____ Date : 11/12/18

Printed Name : Jeff Knight

Entered in computer inventory by: _____ Date : _____

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

DigiBase/NaI Calibration Sheet

Probe Model Number : 12/12/2003 **Customer Name :** Perma-Fix
Probe Serial Number : 020218R **Technician :** Jeff Knight
Date of Calibration : 11/8/2018

Instruments used during calibration					
Model Number:	DigiBase	Serial Number:	18254853	Calibration Due Date:	11/8/2019
Model Number:	44-20	Serial Number:	020218R	Calibration Due Date:	11/8/2019

NIST Traceable Source(s) used:

	Source S/N	Activity(s) µCi	Assay Date
Cs-137	CS-7A-2	7.0000	3/5/2018
MG	1105	1.0200	11/19/2002
Co-60	1105	0.1640	11/19/2002

MGB Properities

High Voltage Setting: 700

Amplifier Settings
Gain: 0.8000
Shaping Time: 0.75µS

ADC Settings:
Conversion Gain: 1024
Lower Level Disc: 10
Upper Level Disc: 1023

Zero Offset Adjustment -11,750
Actual Zero Offset 1.465

(2.92 keV)

Target keV/Channel Data:			As Left keV/Channel Data:		
Isotope	keV	Channel	Isotope	keV	Channel
Cs-137:	661.66	226.21	Cs-137:	661.66	226
Co-60:	1173.2	401.51	Co-60:	1173.2	402
Co-60:	1332.5	456.02	Co-60:	1332.5	456
K-40:	1461	500	K-40:	1461	N/A
Tl-208:	2614	894.6	Ti-208:	2614	N/A

Calibration sticker attached? Yes

Comments :

Initial Calibration of Aipha Spectra 3x3 probe (44-20) married to ORTEC DIGIBASE #18254853

Date instrument is due for next calibration : 11/8/2019

Performed by :
Printed Name : Jeff Knight
Reviewed by : Date : 11/12/18
Entered in computer inventory by: Date :

ATTACHMENT E

Standard Operating Procedure for the Ludlum Model 2241

Environmental Protection Agency R9 Hunter's Point Naval Shipyard	Use Category C	Number R9SOP-XXXX	Page Page 1 of 33
		Revision Revision 00 (Draft Ver B)	Revision Date 00/00/0000 (Draft /7/26/2019)

Operating Procedure for Ludlum Model 2241 -2, -3 Portable Survey Instrument

Responsible Official: David Kappelman Date: 07/24/2019

Technical Review: [print name] Date: _____

Approved By: [print name] Date: _____
Quality Assurance Manager

Approved By: [print name] Date: _____
Radiation Safety Officer

Approved By: [print name] Date: _____
Safety, Health, and Environmental Manager

Approved By: [print name] Date: _____
Site RPM

Approved By: [print name] Date: _____

INITIAL TWO YEAR REVIEW

RO Review/Date: [print name] Quality Review/Date: _____

RO Review/Date: [print name] Quality Review/Date: _____

FIVE YEAR REVIEW

RO Review/Date: [print name] Quality Review/Date: _____

RO Review/Date: [print name] Quality Review/Date: _____

Revisions

Rev. No.	Rev. Date	Revision	Section Number(s)	Responsible Official
01				

Required Supplementary Documents

Document Number	Document Title

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1.0 PURPOSE

This Radiological Response Standard Operating Procedure (RRSOP) describes the operation of the Ludlum Model 2241 portable radiological survey instrument for routine field and emergency response operations for exposure rate and contamination monitoring. This procedure is for the Environmental Response Team (ERT) Ludlum Model 2241-2 and Ludlum Model 2241-3 calibration and detector configurations. The Ludlum 2241 instrument is part of the EPA National Buy Instruments. Regions and other EPA Special Teams may have their Ludlum 2241s calibrated and/or configured with different detectors. It is the end users responsibility to verify that the instrument and detector calibration are suitable for the intended measurement objective.

> WARNING: It is imperative that the end user check instrument specific calibration documents to verify instrument and detector specific calibration information.

The Ludlum 2241 portable radiation can be configured and calibrated to multiple detectors for performing exposure rate and contamination monitoring. The tables within this procedure represent the detector configuration for the Environmental Response Team (ERT) 2241s

The Ludlum Model 2241 is a portable microprocessor-based digital Scaler/Rate meter that can monitor radiation with scintillation, Geiger-Mueller (G-M), and proportional type detectors for measurement of ionizing radiation. The instrument has a Liquid Crystal Display (LCD) with moving decimal point and presents a 4-digit data measurement in the rate meter mode and a 6-digit data measurement in the scaler mode. The display is auto ranging and the units display changes when a different metric prefix is reached.

> NOTE: It is important to include the instrument prefix as displayed when recording measurements since the metric prefix will auto-scale.

2.0 SCOPE AND APPLICABILITY

The purpose of this procedure is to provide instructions for calibrating, functional testing, maintaining, and operating the Ludlum 2241 portable radiological survey instrument.

This procedure applies to routine use of the Ludlum 2241 portable radiological survey instrument by United States Environmental Protection Agency (EPA) personnel and their contractors and is also applicable during emergency response operations. Survey areas may be controlled for protection of personnel, to prevent the spread of contamination, or for the purposes of remediation.

The Environmental Response Team utilizes both the Ludlum 2241-3 and the Ludlum 2241-2 portable radiological survey instruments as summarized below:

- Ludlum Model 2241-3, capable of selecting 1 of 4 possible detectors from the detector selection switch, for obtaining real-time measurements exposure rate or contamination monitoring.

Ludlum Model 2241-2, capable of selecting 1 of 2 possible detectors from the detector selection switch, for performing contamination monitoring.

3.0 INTERFERENCES

Radon gas and the decay progeny of radon may cause interference with air samples or surface wipes. Radon has strong electrostatic properties and will readily adhere to plastics and some other surfaces, giving a false indication of contamination. Allowing 1 to 4 hours for the initial radon daughters to decay followed by re-survey of the item will indicate whether there is actually contamination, or the initial response was the result of the presence of ^{222}Rn.

3.1 Potential Problems

It is imperative that the end use verify that the correct detector number is selected that corresponds with the detector specific calibration for each instrument. Not all 2241-3 or 2241-2 are calibrated with the same detector configuration.

While performing exposure rate measurements, the end user should switch from the Ludlum 44-10 sodium iodide (NaI)Tl to the Ludlum 44-6 or 133-6 Gueiger Mueller probe when 4 mR/hr exposure rate is detected. The NaI detector will saturate around 5 mR/hr. Check calibration paperwork to verify calibration range of detector.

NOTE: Check the calibration range of the detector being used.

4.0 CAUTIONS

4.1 Health and Safety

Personnel must always be aware that exposure to radiation fields and contamination counting may be encountered when performing surveys and removable radioactive material contamination may be present. There is a potential for contamination of the instrument or operator.

- Always wear appropriate personal protective equipment (PPE) such as latex gloves when analyzing samples.
- Practice ALARA principles at all times when handling sources or samples containing radioactive materials.
- Personnel must wear their radiation monitoring badge (dosimeter) whenever analyzing samples from potentially contaminated areas.
- All personnel must be current on annual safety training administered by the Radiation Safety Officer (RSO) and must comply with all requirements, responsibilities, and safety practices outlined in the R&IENL Radiation Safety Manual (RSM).
- Any questions regarding radioactive material and/or radiation safety must be directed to the RSO or the site Health and Safety Officer.

4.2 Equipment

Personnel who perform radiation surveys using this instrument must have a thorough understanding of the types of instrumentation used to detect radiation and understand the capabilities and limits of the instrumentation being used.

- The instrument can accept various contamination probes, and it the end users responsibility to ensure that the correct instrument probe is connected and selected based on review of calibration information.
- The instrument does not measure low energy beta emitters such as tritium or neutron radiation.

5.0 DEFINITIONS AND ACRONYMS

All acronyms are defined in this SOP when used.

6.0 PERSONNEL

6.1 Personnel Qualifications

All personnel who perform radiation surveys using this scaler/ratemeter must have received training on the operation and proper use of the instrument. If training courses are not readily available, all new personnel will learn and perform these procedures under the direct supervision of an experienced user. A Form F1004 "Worker On the Job Training (OJT) Qualification Form" shall be used to document on the job training and demonstration of proficiency, and copies of the form presented to the relevant organization Training Coordinator and Quality Assurance Coordinator (QAC) for archive. Original documentation of formal training shall be maintained and archived by the Quality Assurance Manager.

All experienced personnel will provide management with certificates from courses specific to operation of the instrument or provide project specific work experience. In addition, they will be provided with refresher courses annually or when procedures are modified or changed

Personnel who perform radiation surveys using these scaler/rate meters must have a thorough understanding of the different types of radiation and the risks or hazards associated with each type of radiation activity (alpha, beta and gamma) which may be encountered.

Personnel who perform radiation surveys using these scaler/rate meters must have a thorough understanding of the types of instrumentation used to detect radiation and understand the capabilities and limits of the instrumentation being used.

Personnel who are involved in emergency response or other applications of radiation monitoring must be trained in radiation safety and monitoring practices and must be familiar with ALARA and decontamination concepts.

6.2 Personnel Responsibilities

Personnel using the procedures and instrumentation described in this RRSOP are responsible for consideration of any safety issues or requirements involved with survey or monitoring in radiation contaminated environments.

Personnel who are involved in emergency response or other applications of radiation monitoring are responsible for assuring that instrumentation is maintained in useable condition. Any instruments requiring maintenance or calibration must be identified and turned over to the appropriate personnel.

Personnel who are involved in emergency response or other applications of radiation monitoring are responsible for the proper documentation of the surveys performed using protocols identified by project management. Proper documentation may include calibration data, source check records and instrument response characteristics, in addition to survey or monitoring logs or other data records.

7.0 EQUIPMENT AND SUPPLIES

- Ludlum Model 2241-3 or Ludlum 2241-2 Scaler/ Rate Meter (See Appendix 16.1)
- Ludlum Model 44-20
- Ludlum Model 44-10
- Ludlum Model 44-6
- Ludlum Model 133-6
- Ludlum Model 44-9
- Ludlum Model 43-90
- Alpha Check sources (i.e. ^{239}Pu, ^{230}Th, ^{241}Am)
- Beta Check sources (i.e. ^{14}C, ^{90}Sr, ^{99}Tc)
- Gamma Check sources (i.e. Am-241, Cs-137, Co-60)
- Microsoft Excel® Form F064 “Cincinnati ERT Monthly Response Test”, for each instrument
- D Cell Batteries

Check sources used to determine the efficiency of the detectors or the accuracy of the system must have a certificate of calibration that contains the following information:

- Source Identification number or reference
- Radionuclide and half life
- Radionuclide activity
- Reference date of activity determination
- Reference activity uncertainty at 99% confidence level

Check sources used for repeatability and response characteristics do not require assay of activity. These sources can be used for routine or daily QC checks and will be tracked by the Instrument Manager for statistical analysis of response over time.

8.0 HEALTH AND SAFETY

8.1 Health Cautions

Use of this equipment in contaminated environments may be a source of exposure to personnel. Personnel should always consider ALARA procedures. Appropriate PPE should be worn as needed to prevent external contamination or inhalation of radioactive materials.

These instruments should only be opened by qualified personnel. Access to internal components is a potential source of electrical shock, even when the batteries are removed from the instrument.

8.2 Equipment Cautions

Batteries should not be installed in the instrument and stored without use for more than 30 days to prevent corrosion of the battery compartment.

Check sources used for repeatability and response characteristics do not require assay of activity. These sources can be used for routine or daily QC checks and will be tracked by the Instrument Manager for statistical analysis of response over time.

Check sources used to determine the efficiency of the detectors or the accuracy of the system must have a certificate of calibration that contains the following information:

- Source Identification number or reference
- Radionuclide and half life
- Radionuclide activity
- Reference date of activity determination
- Reference activity uncertainty at 99% confidence level

Always make sure the instrument is off prior to removing or attaching the detector cable. In addition, a change in the detector cable length can cause a shift in calibration.

Sleeving of the instrument, cable, and/or portion of the probe may be required in contaminated areas.

When working in a contaminated environment, it is important to check instrument background readings to ensure that the probe does not become contaminated and affect future readings.

Radioactive sources should be handled with care to prevent damage to the source. Sources utilized with this instrument may be generally licensed, specifically licensed, or exempt quantity. All sources should be handled with care to maintain control, prevent fingerprints and usability.

9.0 SAMPLE COLLECTION, PRESERVATION, AND STORAGE

Screening air filters and swipes in the field may be necessary to prioritize further analyses and direct further work actions, and health and safety.

When further sample analysis is required, samples will be submitted for analysis using Chain of Custody procedures with the required analysis specified. In many cases, especially in emergency response situations, additional analyses will be performed onsite followed by laboratory analyses

10.0 CALIBRATION

All Ludlum Model 2241 scaler/ rate meters used in this procedure shall be calibrated annually, at a minimum, or when instrument repair or repeated failures of instrument QC. If a probe is replaced, the instrument will be recalibrated prior to use.

Calibration shall be performed by the manufacturer or by an authorized Ludlum Calibration and Repair facility. Calibration shall be in compliance with ANSI N323 Calibration Standard for Portable Radiological Instruments.

ERT has standardized the calibration and detector configurations and has the calibration performed by the manufacturer, Ludlum Inc. See Appendix 16.2 and Appendix 16.3. All "yellow highlighted" areads need to be populated for each Ludlum Model 2241 unit and detectors. If the unit is returned to Ludlum Inc, a return authorization number is not required; however, calling the calibration facility ahead of time may help you determine when you want to send instrument for calibration based on backlog and turn-around time. Payment information must also be provided if you do not have an existing account with Ludlum Measurements Inc.

Detector efficiencies may also be established for other specific radionuclides prior to field operations. Ideally, efficiencies should be calculated using sources of the same isotope as the contaminant of concern. However, sources emitting the same type radiation (alpha or beta) as the contaminant of concern, with an energy or average energy near that of the contaminant, are adequate for calibration purposes. Appendix 16.2 and 16.3 specify calibration efficiency determination for the following 5 isotopes for the Ludlum 2241 with a Ludlum Model 44-9 beta-gamma pancake probe: C-14, Tc-99, Cs-137, Cl-36, and Sr/Y-90

11.0 PROCEDURE

11.1 Pre-Operational Checks

11.1.1 Pre Operational Check

Connect the detector to the instrument using the cable supplied with the instrument. Note: Always make sure the instrument is off prior to removing or attaching the detector cable. A change in the cable length can cause a shift in calibration too.

Verify that the meter is within the calibration date by checking the calibration certificate paperwork as well as the calibration sticker on the side of the instrument. Also review the previous QC and/or detector specific control charts if developed.

Ensure that the detector serial number is calibrated to the serial number of the instrument by checking the calibration paperwork accompany each instrument in the equipment case.

Turn the toggle or switch to the RATE or RATEMETER position and verify the following:

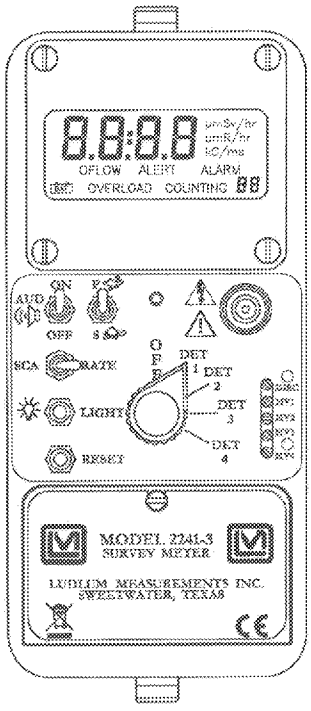


Figure 1: 2241-3 Faceplate

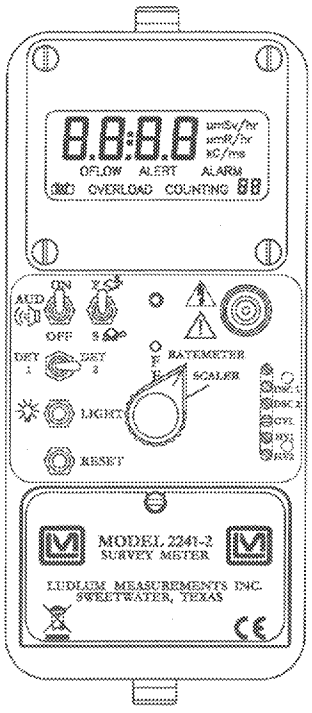


Figure 2: 2241-2 Faceplate

The display should cycle through the following initialization sequence in approximately 5-10 seconds.

The display will perform a display check by showing all "8"s with decimal points. Check to ensure that all segments are on.

Next the firmware number in the format "P-XX YY is dipalyed. The "XX" is the firmware number, and the "YY" is the firmware version

Next the minimum display value for the detector (i.e. 00.00 µR/hr for Ludlum Model 44-10 probe) is visible. Whenever the instrument switch or toggle is in SCALER (SCA) position, the display will show a single "0".

The display will auto-range/scale to the current measurement level. If the display fails to come on and cycle, check to verify batteries are installed in the correct orientation according to the battery compartment lid.

Switch the AUD ON/OFF switch to the ON position and confirm that the external speaker produces an audible click for each event detected. The AUD ON/OFF switch will silence the "clicks" if in the OFF position; however, if an alarm set-point is entered/reached, the alert or alarm will still sound.

Perform a battery check by verifying that the battery icon is visible on the LCD display temporarily during the instrumentation cycle during startup. If the battery icon stay on the LCD display, replace the batteries.

11.1.2 Functional Response Check

Refer to Appendix 16.4 F064 2241 Functional Test Form and F095M VIPER Monitoring Kit Pre-Operational Check Form for the correct sources to use for the given instrument/probe. Mark N/A in areas where a probe is not calibrated to a particular 2241, and mark Not Performed when a probe is calibrated to a 2241 and only one detector/probe is having QC performed to expedite deployment when only one probe will be utilized during the operational period.

- Follow instructions of Form F064 Functional Test Form or F095M VIPER Pre-operation Check Form to complete Daily and Background instrument QC measurements for each detector/probe that will be utilized.

- The instrument is considered ready for use if all daily background QC and source checks "PASS" as determined using the F064 2241 Functional Test Form or the F095M Form as appropriate.

Periodic QC measurements should be made approximately monthly if the instruments will be placed into storage and not used routinely for radiological work to continue to verify that the instrument will be operational when needed.

If 2241 Functional Checks are not required to be Control Charted based on DQL, skip to Section 11.3 Operation

11.2 Establishing Control Charts

If the instrument's control chart bounds have not been set, complete the control limits tab for both RATEMETER/RATE and SCALER/SCA.

11.2.1 Collect Control Chart Data

Perform a minimum of 30 successive QC measurements of the background and the lantern mantel on the side of the instrument for each detector as described below.

Background

Establish the system background by performing background measurements in RATEMETER/RATE mode and SCALER/SCA mode as specified in the F064 Ludlum Model 2241 Functional Test Form or F-095M VIPER Pre-Operational Check Form (See Appendix 16.4).

Using lantern mantel source on the side of instrument or a calibration check source and jig, if required, of known (traceable) activity of the radionuclide in question, enter the source(s) information into the appropriate cells of form E3000 Ludlum Model 2241 Data Sheet. The form will auto-calculate the mean count rate and percent deviation (rate-meter mode) and standard deviations (scaler mode) for setting up QC bounds for each detector.

QC Bounds should be determined manually onsite where QC will be performed as needed.

Efficiency

If a known source and jig are incorporated into Daily QC, the instrument efficiency for each source is auto-calculated by the form and is reported in cells B2 and B3, using the formula shown in Section

13.1, Detector *Efficiency*. Compare results to the efficiency values listed on the instrument calibration forms in the instrument case. If there are large discrepancies, seek clarification with appropriate radiological personnel.

11.2.2 Control Limits

Control limits (QC bounds) are auto-calculated on the E3001 form. The form will auto-calculate the mean count rate and percent deviation (rate-meter mode) and standard deviations (scaler mode) for setting up QC bounds for each detector.

Rate meter mode instruments controls are based on percent variations from the average. An instrument used in rate meter mode is operational if it meets the criteria in Table 1.

Table 1 Control Chart for Rate-meter Mode

Criteria	Action
≤ 10% of the average	Instrument can be used
> 10 to ≤ 20% of the average	Two or more readings should be taken
≤ 10% of the average for both subsequent readings	Instrument can be used
> 10% to ≤ 20% of the average for both subsequent readings	Should be evaluated by a Health Physicist
> 20% of the average	Instrument fails and should be returned for maintenance or recalibration

Scaler mode instrument controls are based on an evaluation of standard deviation from the norm. Typically, an instrument is operational if it meets the criteria defined in Table 2. If the quality control check is outside the acceptable limits, additional data may need to be collected.

Table 2 Control Chart Criteria for Scaler Mode or when required for Rate-Meter Mode

Criteria	**Action**
≤ 2 standard deviations	Instrument can be used
> 2 to ≤3 standard deviations	Two more readings should be taken
≤ 2 standard deviations for both subsequent readings	Instrument can be used
> 2 to ≤ 3 standard deviations for both	Should be evaluated by a Health Physicist subsequent readings
> 3 standard deviations	Instrument fails and should returned for maintenance or recalibration

Once these limits are established, the counter can be considered ready for use if, on each day the instrument is used, all daily background QC and source checks indicate a PASS" if manually determined using the F064 2241 Functional Test Form or F095M VIPER Pre-Operational Check Form.

11.3 Operation

11.3.1 Verify QC

Verify that a valid calibration sticker is attached to the side of the Ludlum Model 2241 instrument and the detector to be used is calibrated to the 2241 being utilized for measurements.

Verify that instrument QC has been performed by reviewing Form F064 2241 Functional Test for the detector to be used. If QC needs to be performed go back to step 11.1. If QC has been performed and is satisfactory, perform the following:

Examine the 2241 for any obvious physical damage that could interfere with its proper operation. Perform a battery check prior to performing surveys to verify that the battery icon is visible on the LCD temporarily during start up of the instrument, but the battery icon should NOT remain on. If the battery icon stays on, replace batteries.

11.3.2 Detector Selection

Selected the appropriate detector and ensure the detector is calibrated to the 2241.

Place the DETECTOR SELECTOR switch in the appropriate position.

Place the RATEMETER(RATE)/SCALER(SCA) switch or toggle in the appropriate position for the survey work to be performed.

> NOTE: While performing gamma exposure rate surveys, start with the Ludlum 44-10 detector/probe for taking measurements in the exposure rate range of Background up to 4 mR/hr. Then switch to the Ludlum 44-6 or 133-6 detector/probe for taking measurements > 4 mR/hr up to 100mR/hr. Switch to an ion chamber instrument (Eberline RO-20 or Fluke V451B) for taking measurements > 100mR/hr.

Record all measurements and locations in logbook and on all required documentation whether hardcopy or electronic. Typically a survey form will be utilized, but the form may vary from site to site.

When the 2241 VIPER kits that are being utilized for the electronic collection of 1 sec scanning data, record the start and stop times and scanning general location in the logbook and verify that VIPER is recording the data. See VIPER Users Guide

Exposure Rate Measurements			
	Ludlum 44-10	Ludlum 44-6	Ion Chamber
Survey Use	Gamma survey	Beta/Gamma Survey	Switch Instruments
	Background to 4mR/hr	>4mR/hr - <100mR/hr	>100mR.hr

Contamination Survey Measurements			
	Ludlum 44-9	Ludlum 43-90	
Survey Use	Beta/Gamma Background to 800Kcpm	Beta/Gamma Survey Background to 800Kcpm	

VIPER Scanning Measurements			
	Ludlum 44-20	Ludlum 133-6	Ion Chamber
VIPER Survey Use	Gamma Count Rate/Exposure Rate Mapping	Gamma Count Rate/Exposure Rate Mapping	Switch Instruments
	Background to 4mR/hr	>4mR/hr - <100mR/hr	>100mR.hr

See Appendix 16.7 Ludlum Detector Energy Response Curves

The instrument and probe combination should be calibrated to the isotope of concern when feasible; otherwise, a conservative calibration efficiency from another isotope should be selected. All measurements taken should reflect what isotope efficiency was utilized. (i.e. “Cs-137 equivalent, Sr/Y-90 equivalent, etc)

Exposure rate surveys should be performed at approximately 1 meter (waist level) and near contact within 2" from closest physical boundary or as directed by the Quality Assurance Project Plan/Work Plan (QAPP).

Contamination surveys should be performed within 2" for beta/gamma surveys, and less than 1" for alpha contamination surveys.

Contamination survey speed should be approximately 2"/second for beta/gamma surveys or 1"/second for alpha surveys. A general rule of thumb is to perform scanning surveys at one probe width per second unless directed otherwise.

Follow site specific instructions of when to perform a static scaler measurement. Scaler count time may need to be adjusted to meet site specific MDA requirements annotated in the QAPP or SAP. If scaler measurement time needs to be adjusted, contact onsite Radiological Logistics or HP to adjust as required to meet site specific MDA requirements.

If beta/gamma screening of swipes and/or air filters is required to be performed using the Ludlum 2241, use the Ludlum Model 180-2 sample holder in conjunction with the Ludlum Model 44-9 probe. A site-specific special use procedure will need to be developed that will instruct the end user what efficiency and 180-2 sample position to use for scaler counting.

11.4 Pollution Prevention

Contaminated materials in the form of PPE and waste materials will be containerized and marked for proper disposal and transferred to the custody of the site contamination control corridor (hotline) personnel. It is important to segregate and contain contaminated materials to prevent the spread of contamination into the environment. When performing surveys within a radiological controlled and/or exclusion area, only take in what equipment and materials are necessary to perform assigned tasks.

If contaminated water is part of the waste stream, careful planning must occur to ensure that it is contained at the hotline in the appropriate storage containers.

11.5 Waste Management

Mark all waste containers as either contaminated or uncontaminated. Segregate all waste materials into the appropriate containers. Uncontaminated waste, once evaluated and cleared by Rad Safety or other appropriate individuals, can be disposed of using normal waste stream methods specified by the Site Safety Officer and/or Radiation Safety Officer (RSO).

All contaminated materials (forceps, gloves, etc.) collected during survey operations must be placed into containers that are marked as contaminated. These items must be disposed of following regulatory requirements for the type of waste being generated (low level radioactive, mixed waste or hazardous waste, etc.). Contain these materials and coordinate their removal and proper disposal with the Site Safety Officer for the response.

12.0 QUALITY ASSURANCE AND QUALITY CONTROL

12.1 Quality Control

Functional checks will be performed at the beginning and end of each operational period, or as required in the QAPP or SAP. The instrument must meet all pre-operational requirements described in Section 11.1, *Pre-operational Checks*, of this SOP prior to operation of the instrument.

If the instrument fails a pre-operational check, the instrument will be removed from service immediately for evaluation by the Radiation Safety Officer or lead Health Physicist onsite.

If samples are being taken in conjunction with survey/scanning measurements, consult the sampling and analysis plan or project QAPP for specific blank and duplicate analysis rates.

12.2 Records Management

All data collected using the Ludlum Model 2241 Ratemeter/Scaler instrument will be entered with the date, time, location, background and elevated readings (if any) in a laboratory note book in addition to any analysis forms, documents, or electronic spreadsheet being utilized.

After completion of survey work, all documentation and copies of electronic files (including appropriate copies of logbook entries) will be provided for assembly into a daily work package and submitted for review by the lead Health Physicist and provided to the RPM/OSC for archiving for the Administrative Record.

The On Scene Coordinator (OSC), Remedial Project Manager (RPM), or contractor designated by them will be responsible for assuring that documentation is copied and distributed properly and archived in the appropriate manner for the site.

12.3 Computer Hardware and Software Management

There are no specific requirements in place for the management of computer hardware or software associated with radiation surveying at the time of this writing. Some federal organizations are in the process of transition to computer-based documentation for recording data and will require management processes to be defined when the programs are established. The ERT VIPER data collection and security plans for data storage have been approved by the EPA Office of Environmental Information.

12.4 Procurement Requirements

There are no specific procurement requirements associated with procurement or use of the Ludlum Model 2241.

12.5 Audits

Periodic internal self assessments of this procedure by qualified personnel are recommended to assure that the procedures are accurate and that changes are incorporated in a timely manner.

12.6 Corrective Actions

If a procedural non-conformance is discovered or one occurs due to unforeseen circumstances, the non-conformance issue must be documented using Form F1003 “Corrective Action Report”. Follow the process for disposition and resolution of the corrective action as described on the back of the form.

13.0 DATA ANALYSIS AND CALCULATION

13.1 Detector Efficiency (performed for each detector/source type)

Note: The activity of the source used for this determination must be certified and the current activity must be calculated based on radionuclide decay for accuracy.

$$\%Eff_{source} = \left(\frac{CPM_{Source} - Cpm_{Bkgd}}{DPM_{Source}}\right) \text{ x } 100\% \qquad \text{Eq. 1}$$

Where: CPM_{Source} = Counts per minute of the source

CPM_{BKGD} = Counts per minute of the background count

DPM_{SOURCE} = Decayed activity of the source in disintegrations per minute (dpm)

13.2 Crosstalk Calculations, defined but not required for Ludlum Model 2241Scaler/Rate-meter operation

Alpha/Beta crosstalk and crosstalk correction is not required to be utilized for Ludlum Model 2241 Scaler/Ratemeter.

Beta in Alpha channel crosstalk will occur when Beta radiation is present and a portion of the beta pulses are detected in the alpha channel and show up as alpha counts. This value should be ≤ 1% but may indicate the presence of alpha particles when there are none.

$$C_{Beta} = \left(\frac{Counts\ in\ Alpha\ Channel}{Counts\ in\ Beta\ Channel}\right) \times 100 \qquad \text{Eq. 2}$$

Where: C_{Beta} = % Beta Crosstalk

Alpha in Beta channel crosstalk will occur when Alpha radiation is present and a portion of the alpha pulses are detected in the beta channel and show up as beta counts. This value should be ≤ 10% but may indicate the presence of beta particles when there are none.

$$C_{Alpha} = \left(\frac{Counts\ in\ Beta\ Channel}{Counts\ in\ Alpha\ Channel}\right) \times 100 \qquad \text{Eq. 3}$$

Where: C_{Alpha} = % Alpha Crosstalk

13.3 Determination of MDA for SCA/SCALER counting mode

The following equation can be used to determine the minimum detectible activity (MDA) distinguishable from background at the 95% confidence level;

$$MDA = \frac{2.71 + 3.29\sqrt{R_b t_s\left[1 + \frac{t_s}{t_b}\right]}}{(t_s)(E)} \qquad \text{Eq. 4}$$

Where: R_b = Background count rate in CPM

t_s = Sample counting time in minutes

t_b = Background counting time in minutes

E = Detector efficiency in counts per disintegration for closest or conservative nuclide energies

MDA = Minimum Detectable Activity in DPM/Sample

This equation can be modified to determine the Lower Limit of Detection (LLD) for an air sample as follows:

$$LLD = \frac{2.71+3.29\sqrt{R_b t_s\left[1+\frac{t_s}{t_b}\right]}}{(t_s)(E)(E_f)(FF)(SAF)(V)(2.22E6)} = \text{MDA}/(E_f)(FF)(SAF)(V)(2.22E6)$$

Eq. 5

Where: LLD = Lower limit of detection in µCi/cm^3

Rb = Background count rate in CPM

t_s = Sample counting time in minutes

t_b = Background counting time in minutes

E = Detector efficiency in counts per disintegration

E_f = Collection efficiency of the filter

FF = Fraction of the filter that is counted

SAF = Self absorption factor (filter)

V = Sample Volume in cm^3

2.22E6 = Conversion factor DPM to µCi

14.0 DATA REVIEW

The technician performing measurements is responsible for review and verification all documentation prior to submission of the data collected. Ensure that all documentation and Chain-of-Custody forms, if further analysis will be performed, are complete and correct and that survev data is complete and fulfils the requirements for how the data will be used.

15.0 REFERENCES

15.1 Specifications and Requirements

15.2 Guidance Documents or other special references

Ludlum Measurements, Inc., "Instruction Manual for Ludlum Model 2241-2 dated August 2012

Ludlum Measurement, Inc., "Instruction Manual for Ludlum Model 2241-3 dated September 2012

Ludlum Measurements, Inc., "Detection Sensitivity and MDA (Parts 1 and 2)", Ludlum Report, Volume 13, Number 1, December 1998 and Volume 14, Number 1, March 1999

Lloyd Currie MDA calculations

VIPER Data User Guide

16.0 APPENDICES

16.1 Diagram of Ludlum Model 2241 Faceplates

16.2 Ludlum 2241-3 Standardized Calibration Request Form

16.3 Ludlum 2241-2 Standardized Calibration Request Form

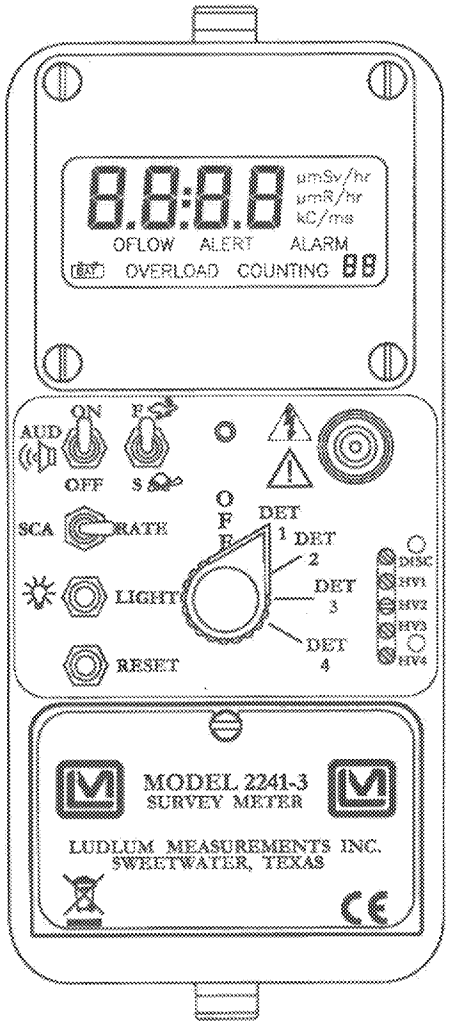
16.4 Excel Form F064 "Ludlum Model 2241 Response Test"

16.5 Environmental Response Team (ERT) Radiological Data Quality Levels

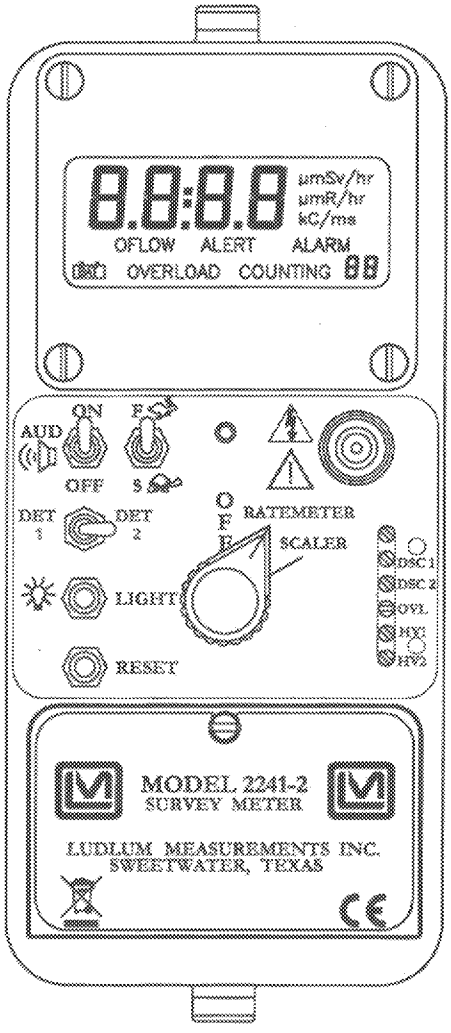
16.6 Excel Form F095M "VIPER Monitoring Kit Pre-Operational Check"

16.7 Detector Energy Response Curves

Appendix 16.1, Ludlum Model 2241Faceplates



Model 2241-3 Faceplate



Model 2241-2 Faceplate

Appendix 16.2 Ludlum Model 2241-3 Calibration Request Form

LUDLUM MEASUREMENTS, INC

501 Oak Street
Sweetwater, Texas 79556
1-800-622-0828 325-235-5497 Fax: 325-235-4672
www.Ludlums.com

► INSTRUMENT RETURN FORM ◄

Date: MM /DD/ YYYY Item(s) returned for ☒ Calibration ☐ Repair ☒ Other _____

Company Name: Insert Office/Region that can answer questions regarding calibration request

Contact Person: _____ (End User) Phone: ( ) _____

LMI Account # _____

Bill to Address: Ship to Address:

Ship Via: ☒ UPS ☐ Fedex ☐ Other Ground

Instrument/ Probe Model Number	Serial Number	Instrument/ Probe Model Number	Serial Number
2241-3 44-10 44-6 44-9 43-90 (Case XXXX)	Instrument Serial # Probe Serial # Probe Serial # Probe Serial # Probe Serial #	2241-3 44-10 44-6 44-9 43-90 (Case XXXX)	Instrument Serial # Probe Serial # Probe Serial # Probe Serial # Probe Serial #
2241-3 44-10 44-6 44-9 43-90 (Case XXXX)	Instrument Serial # Probe Serial # Probe Serial # Probe Serial # Probe Serial #	2241-3 44-10 44-6 44-9 43-90 (Case XXXX)	Instrument Serial # Probe Serial # Probe Serial # Probe Serial # Probe Serial #

Purchase Order # _____ ☐ Call for PO# ☐ Call with Est ☐ Call for CC#

Credit Card # _____-_____-_____-_____ Expiration _____/_____

Contact Person: _____ Phone: ( ) _____

Fax: ( ) _____ E-mail: _____

Malfunctioning Symptoms, Special Instructions, etc: Please calibrate 2241-3 and probes with

Det 1: 44-10 in uR/hr calibrated with Cs-137 with calibration points at 0.1, 0.5, 2, 5, 10 mR/hr provide Forms C4A & C17-1D)

Det 2: 44-6 in mR/hr calibrated with Cs-137 with calibration points at 1, 1.5, 5, 15, 50, 150 mR/hr (provide Forms C4A and C17-1D)

Det 3: 44-9 in cpm calibrated with a Tc-99 sorce that is larger than the active area of the probe. Report a 4 π efficiency (the source does not need to be larger than the active area of the probe) in cpm /dpm for the following isotopes: C14, Tc99, Cs137, Cl36, Sr/Y-90 Forms C17-1A and C17-1D)

Det 4: 43-90 in cpm calibrated with Th-230 source. Report 4 π efficiency in cpm /dpm and 2 π efficiency in cpm for Th-230 and Pu-239 as reported on Form C21

2241-3 units: Please verify that the display is functioning correctly, some cannot be read.

Appendix 16.3 Ludlum Model 2241-2

LUDLUM MEASUREMENTS, INC

501 Oak Street
Sweetwater, Texas 79556
1-800-622-0828 325-235-5497 Fax: 325-235-4672
www.Ludlums.com

► INSTRUMENT RETURN FORM ◄

Date: MM /DD/ YYYY Item(s) returned for ☒ Calibration ☐ Repair ☒ Other _____

Company Name: Insert Office/Region that can answer questions regarding calibration request

Contact Person: _____ (End User) Phone: ( ) _____

LMI Account # _____

Bill to Address: _____

Ship to Address: _____

Ship Via: ☒ UPS ☐ Fedex ☐ Other Ground

Instrument/ Probe Model Number	Serial Number	Instrument/ Probe Model Number	Serial Number
2241-2 44-9 43-90 (Case XXXX)	Instrument Serial # Probe Serial # Probe Serial #	2241-2 44-9 43-90 (Case XXXX)	Instrument Serial # Probe Serial # Probe Serial # Probe Serial # Probe Serial #
2241-2 44-9 43-90 (Case XXXX)	Instrument Serial # Probe Serial # Probe Serial # Probe Serial # Probe Serial #	2241-2 44-9 43-90 (Case XXXX)	Instrument Serial # Probe Serial # Probe Serial # Probe Serial # Probe Serial #

Purchase Order # _____ ☐ Call for PO# ☐ Call with Est ☐ Call for CC#

Credit Card # _____ - _____ - _____ - _____ Expiration _____ / _____

Contact Person: _____ Phone: ( ) _____

Fax: ( ) _____ E-mail: _____

Malfunctioning Symptoms, Special Instructions, etc: Please calibrate 2241-2 and probes with

Det 1: 44-9 in cpm calibrated with a Tc-99 sorce that is larger than the active area of the probe. Report a 4 π efficiency (the source does not need to be larger than the active area of the probe) in cpm /dpm for the following isotopes: C14, Tc99, Cs137, Cl36, Sr/Y-90 (Forms C17-1A & C17-1D

Det 2: 43-90 in cpm calibrated with Th-230 source. Report 4 π efficiency in cpm /dpm and 2 π efficiency in cpm for Th-230 and Pu-239 as reported on Form C21

2241-2 units: Please verify that the display is functioning correctly, some cannot be read.

Call if you have any questions.

Ludlum Model 2241-2: VIPER Calibration Request Form

LUDLUM MEASUREMENTS, INC

501 Oak Street
Sweetwater, Texas 79556
1-800-622-0828 325-235-5497 Fax: 325-235-4672
www.Ludlums.com

► INSTRUMENT RETURN FORM ◄

Date: 02 Jul 2019 Item(s) returned for ☒ Calibration ☐ Repair ☒ Other Firmware

Company Name: Tetra Tech EMI (for the USEPA)

Contact Person: Doug Draper (End User) Phone: (859) 594-6545

LMI Account # 20694 **Ludlum Contact: Jeremy Thompson**

Bill to Address:

Ship to Address:
4820 Olympic Blvd
Erlanger, KY 41018

Ship Via: ☒ UPS ☐ Fedex ☐ Other Ground

Instrument/ Probe Model Number	Serial Number	Instrument/ Probe Model Number	Serial Number
Viper-2 Unit		Viper-3 Unit	
2241-2	198274	2241-2	198305
44-20	PR334950	44-20	PR334952
133-6	PR202221	133-6	PR202224

Purchase Order # ☐ 1063138 ☐ 1063139 ☐ Call for PO# ☐ Call with Est ☐ Call for CC#

Credit Card # _____ - _____ - _____ - _____ Expiration _____ / _____

Contact Person: Mike Valerius Phone: (859) 594-6547

Fax: (859) 594-6556 E-mail: mike.valerius@itemi.com

Malfunctioning Symptoms, Special Instructions, etc: Calibrate 2241-2 using Form C22E

Please replace firmware with IC-AT89C51RC2-SLSUM 44PLCC 32K F firmware; return old units

Calibrate Det 1 for 133-6 in mR/hr and then Det 2 for 133-6 in cpm using Form C17-1D

Calibrate Det 2 for 44-20 in cpm, and then Det 1 for 44-20 in uR/hr using Form C17-1D

Ensure calibration overlap between 44-20 & 133-6 in both cpm and mR/hr scales (1 or 2mR/hr)

Normal field operation is the 2241-2/ 44-20 in uR/hr or cpm, but other modes may be necessary

Please calibrate the 44-20 through the protective casing which is how it will be used in the field

Form 34 rev 5-11

Appendix 16.4 Excel Form F064 "Ludlum Model 2241 Functional Response Test"

Cincinnati ERT 2241 Functional Response Test

Date	Cal Date	Cal Due	DQL	1, 2, 3
Temp	Pressure	Humidity	Shelf	201-A
2241-2 or-3	CERETS	Case #	Th Src?	

Jigs: None required
Check source: Thorium lantern mantle on side of 2241 (~0.03 uCi)
NOTE: The instrument is very sensitive to the cable shorting out. Do not bend cable sharply
Record readings in Table 1. Annotate unexpected or unusual conditions in Comments Section

- ☐ Open case and verify contents with serial numbers posted on the outside of the box and with the inventory list. Verify that the calibration sticker is in place and the instrument is within calibration. Compare probe serial numbers to Calibration Sticker.
- ☐ Verify Document Packet includes instrument manuals and cal certificates.
- ☐ Verify Control Charts (Ratemeter mode) are present for the 44-10, 44-6, 44-9 and 43-90 probes.
- ☐ Verify that a type C / type C cable, serial cord, extra batteries and carrying strap are present
- ☐ Remove 2241 from case and inspect for any visible damage or unusual conditions. Select Audio OFF, F/S to F, attach Type C cable to 2241-3. Move Selector to RATE by lifting toggle.

Table 1. Response Kit Instrument Readings

	44-10 (uR/hr)	44-6 (uR/hr)		44-9 (cpm)		43-90 (cpm)
		Win closed	Win open	Cover On	Cover Off	
Background Rate						
Src Reading Rate						
Net Reading Rate						
SCA Background						
SCA Reading						
SCA Time	10 sec	10 sec	10 sec	30 sec	30 sec	30 sec

- ☐ Attach cable from 2241-3 to 44-10 gamma probe. Turn instrument ON by selecting DET 1 Record the background reading (away from sources) after ~30 seconds (typically ~ 5 uR/hr).
- ☐ Place Gamma probe, end first, against the source (Source holder cover CLOSED) and record the reading. (The reading should be approximately 20 uR/hr above background.) Record Net Reading rate on the L44-10 Control Chart for this kit.
- ☐ Switch from RATE to SCA. Push black button in handle and record background after the count is complete (COUNTING indicator goes out). Count and record Th source.
- ☐ Check audio using the toggle switch. Check light using red button. Turn 2241-3 to OFF.
- ☐ Select RATE. Attach GM probe (44-6) to cable and turn instrument to Detector 2 position. Record background reading with window CLOSED after ~30 seconds; repeat window OPEN.
- ☐ Place GM probe (44-6) with window CLOSED next to instrument check source door CLOSED and note reading after about 30 seconds (Readings ~40 to 60 uR/hr).
- ☐ Test the probe and source again with the window OPEN. The reading should be ~50% higher than with the window CLOSED reading. Record readings in Table 1. Record Net Reading rate on Control Chart.
- ☐ Switch from RATE to SCA. Push black button in handle and record background with window CLOSED and window OPEN. Repeat counting check source. Turn the instrument to OFF. Remove 44-6 probe, replace in case with window CLOSED.

Name	Date	Verified by	Date

File original of this form in the Instrument File. Place a copy in the Instrument Case Document Package.

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Cincinnati ERT 2241 Functional Response Test

- ☐ Select RATE or RATEMETER. Attach the 44-9 pancake probe (44-9) with red cover still ON.
  Select Detector 3 for 2241-3 or Detector 1 for 2241-2
  Record background count rate after ~30 seconds. Take source reading (source holder cover OPEN). Readings should stabilize at approximately 3 kcpm. Take another background and source reading with the red cover OFF. With red cover OFF the readings should increase ~3 times. Record this reading in the Table and on the Control Chart.
- ☐ Switch from RATE/RATEMETER to SCA/Scaler. Push black button in handle and record background with window OPEN and window CLOSED. Repeat counting Th source. Turn the instrument to OFF.
  Remove 44-9 probe from the cable, replace in case with red cap on 44-9 probe.
- ☐ Select RATE or RATEMETER. Attach 43-90 alpha probe. Remove plastic probe cover.
  Select Detector 4 for 2241-3 or Detector 2 for 2241-2
  After ~30 seconds record background reading in cpm in Table 1 (should be ~0 cpm).
- ☐ Take reading on instrument check source (~ 300- 500 cpm) with Source Holder door OPEN.
  Record data in table. Record Net Reading rate on the 43-90 Control Chart.
- ☐ Switch from RATE/RATEMETER to SCA/SCALER. Push black button in handle and record background. Repeatcounting check source. Turn the instrument to OFF. Remove cable and 43-90 probe, replace probe in case with plastic cover in place. Switch from SCA/SCALER to RATE/RATEMETER
- ☐ Remove batteries. Replace all components and Model 2241 in case.

Control Charts

Note: It is important that readings are taken in a low background area. Nearby sources or variable background will affect the interpretation of results.

Note: If a unit/ probe combination does not pass the following criteria, notify the Radiological POC BEFORE using the instrument.

Control Charts in this procedure use the Net Counting Rate. The Control Charts have two control levels, one at +10% and the other at +20% of the average reading. The acceptability of the instrument/ probe performance is based on current and historical performance compared to these control levels.

If the reading is within the +10% control band of the historical average the unit is acceptable.

If the reading is between +10% and +20%, take two more readings. If these are both +10% the unit is acceptable. If one reading is within +10% and the other is between +10% and +20%, consult with the Radiological POC.

If a reading is more than +20%, the unit does not pass.

If the last 3 readings on the Control Chart have been greater than or less than the average, consult with the Radiological POC.

If the last 5 readings have been greater or less than the average, the unit does not pass.

If the last 7 readings have been increasing or decreasing, the unit does not pass.

- ☐ Unit and all 4 probes DO Pass
- ☐ Unit and one or more probe combinations do/ does NOT Pass. Note in Comments.

Comments/ Problems noted:

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Appendix 16.5 Environmental Response Team (ERT) Radiological Data Quality Levels.

16.5 Data Quality Level (DQL)

16.5.1 Determine the DQL based on the expected instrument use and data quality objectives as directed by the site specific Quality Assurance Project Plan (QAPP) and/or the site specific Sampling and Analysis Plan (SAP).

16.5.2 Table 1 establishes the DQLs (1-3) for monitoring with radiation detection instrumentation. These DQLs apply a graded approach for collecting radiation data.

- Level 1 represents the highest quality of data, while Level 3 represents the lowest.
- Table 1 defines each level, and describes instrument use, DQO data requirements, field surveys, and appropriate quality controls and checks. As shown in Table 1:
  - DQL-1 qualified instruments are used to release items following decontamination procedures.
  - DQL-2 instruments are used for most monitoring operations, pre-job and post-job surveys, and other support
  - DQL-3 instruments are used early on to determine if there is a radiological hazard and if so, the general areas of the most concern.
- Control charts are developed for each instrument used to make measurements corresponding to DQL-1 or 2. The control chart is typically based on an average instrument reading of a quality control source that is counted in a reproducible geometry. When an instrument is put into service and used to take DQL-1 or DQL-2 measurements, a control reading should be taken with the instrument, the appropriate QC source, and jig. The results of the check are then plotted on the control chart.
- For DQL-1 measurements, another check is performed at the conclusion of the readings, and that value is plotted on the control chart as well. For instruments that are in routine use, control charts typically have a one-week duration.

16.5.3 Apply the instrument quality controls and checks as directed by Tables 1 and 2.

Table 3 Data Quality Levels and Instrument Quality Checks

Data Quality Level	Data Quality Objectives – Data Requirements	Instrument Use	Instrument quality controls and checks
1	• Data is used for risk assessment • Data is used for interagency comparability • Data is generated for regulatory compliance	• Measurement • Operational Surveys • Release surveys • Remediation Surveys • Special Surveys	• Instrument is calibrated annually or has a technical basis document • Representative background is established where the instrument control checks are performed

Data Quality Level	Data Quality Objectives – Data Requirements	Instrument Use	Instrument quality controls and checks
			• Prior to use, a control chart is developed with a reproducible geometry and quality control (QC) source at the field logistics center or instrument storage • A QC source check is performed before and after field use • A source response check is performed and documented at scheduled times during field use
2	• Data is used to monitor changing conditions within defined boundaries • Data is specific to an operation or activity • Data is comparable to other data collected at this scene • Data is used to provide immediate recognition of unexpected changes in radiation levels or quality	• Measurement • Operational Surveys • Remediation Surveys • Special Surveys	• Instrument is calibrated annually or has a technical basis document • Representative background is established where the instrument control checks are performed • A source response source check is performed and documented before and after field use and at scheduled times during the use of the instrument in the field
3	• Data is obtained quickly • Data is used to determine if controls for radioactive materials are necessary • Data is comparable only to other data collected by this instrument during this use	• Detection • Operational Surveys	• Instrument is calibrated annually or has a technical basis document • Prior to use, a background value is determined • Prior to use, a source response source check is performed to verify that the instrument responds to the radiation of interest

Appendix 16.6 Excell Spreadsheet F-095M VIPER Monitoring Kit Pre-Operational Check

Cincinnati ERT Viper Monitoring Kit Pre-Operational Check (Cases 121-123)

Case #	2241-2 SN	CERETS	Shelf Loc
44-20 SN	CERETS	Other Det	Other SN
Todays Date	Cal Date	Cal Due	DQL* 2,3
Temp F	Pressure "	Humidity%	Test Loc Warehouse

Jigs: None required **Check source:** Thorium lantern mantle on side of 2241-2 (~0.03 uCi)

NOTE: The instrument is set up for 44-20 field use. A different probe can be tested for use.

NOTE: Tests can be omitted for probes that will not be used in the field.

Step Record readings in Table 1. Annotate unexpected or unusual conditions in Comments Section on back.

1. Open case and verify contents with serial numbers posted on the outside of the case and with the inventory list (Table 2). Verify that the calibration sticker is in place and the instrument is within calibration. Verify Document Packet includes instrument manuals and Calibration Certificates. Compare probe serial numbers to Calibration Certificate. Verify the scaler times for Det 1 & 2 are set to 60 sec and 60 sec. From the Calibration Certificate, record the Deadtime and Calibration Constants.
2. Annotate if Control Charts (Ratemeter mode) are present in Comments.
3. Remove 2241-2 from the case and inspect for any visible damage or unusual conditions. Select Audio OFF and F/S to F. Attach Type C cable to 2241-2. Move Selector to RATE by lifting toggle. Turn ON for 2 min.
4. **Table 1. Response Kit Instrument Readings**

	44-20 (3x3 NaI)		44-20 Unit	Other		Comments
	Det 1 uR/hr	Det 2 kcpm	fails if SCA	Det 1 uR/hr	Det 2 cpm	
HV (Calib Certificate)			source			
Deadtime Correction			reading			
Calibration Constant			varies more			
Background Rate			than 20%			
Background Scaler			from the			
Source Rate			ratemeter			
Source Scaler			reading. Unit			
Net Rate			Fails if			
Net Scaler			background			
SCA Time (seconds)	60	60	<1 kcpm or >25 kcpm.	60	60	

5. Turn 2241-2 OFF. Connect to a 500-2 if available. Select Detector 1, turn ON. Check and record HV at 50 kcpm, and +35mV on the 500-2. Record HV, adjust if >+3 v. Select Det 2, verify HV within +3v. Turn OFF
6. Select Det 1, Ratemeter. Connect 44-20. Take background reading and record. Take source reading, door closed. Switch from RATE to SCA. Push black button in handle and record background in counts, then take an integrated reading and record in counts. Select Det 2, take rate and scaler readings.
7. To check a **different probe**, remove the instrument package from the can, disconnect the serial and speaker cables. Select Det 1. Select Position 1 on the Rotary Switch, input the uR/hr Deadtime correction for the probe. Select rotary Position 2 and input the Calibration Constant. Select Det 2 and input the ratemeter and scaler info. Connect 2241-2 to the 500-2 and turn instrument ON. Check HV for Det 2 and Det 1. Turn OFF and disconnect. Connect probe, select RATE, turn instrument ON. Record background and source reading in uR/hr. Select Det 2 and take ratemeter and scaler background and source readings.
8. Ensure Deadtime and Calibration Constants are input for the probe that is to be used in the field. Verify correct HV for Det 1 and 2. When finished, remove batteries, replace components in case.
9. Unit is ready to be placed into field use for the 44-20. To use another probe, set up 2241-2 per Step 7.

Name	Date	Verified by	Date

File original of this form in the Instrument File. Place a copy in the Instrument Case Document Package.

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* DQL is the C-ERT Data Quality Level

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Cincinnati ERT Contamination Monitoring Kit Pre-Operational Check (Cases 121-123)

Use of Control Charts

Note: It is important that readings are taken in a low background area. Nearby sources or variable background will affect the interpretation of results.

Note: If a unit/ probe combination does not pass the following criteria, notify the Radiological POC BEFORE using the instrument.

Control Charts in this procedure use the Net Counting Rate. The Control Charts have two control levels, one at +10% and the other at +20% of the average reading. The acceptability of the instrument/ probe performance is based on current and historical performance compared to these control levels. If Contol Bounds based on ± 1,2,3 Sigma have been calculated use them.

If the net reading is within the ±10% or 1 SIGMA of the control band of the historical average the unit is accepta

If the net reading is between ±10% and ±20%, take two more readings. If these are both ±10% the unit is acceptable. If one reading is within ±10% and the other is between ±10% and ±20%, consult with the Radiological POC.

If a net reading is more than ±20%, the unit does not pass.

If the last 3 readings on the Control Chart have been greater than or less than the average, consult with the Radiological POC.

If the last 5 readings have been greater or less than the average, the unit does not pass.

If the last 7 readings have been increasing or decreasing, the unit does not pass.

The Unit and following probes PASS ☐ 44-20 ☐ Other _____
Annotate in comments the reason(s) any probe combination that does NOT Pass.

Comments/ Problems noted:

Table 2. Case Contents			
Ludlum 2241-2	3x3 NaI probe 44-20		Battery case w/ D cells
Type C cable	Serial cable	Carrying strap	44-20 handle
Viper Components			
Linc unit	Radio antenna	GPS antenna	Green 8 GB flash drive
Linc/ 2241-2 serial cable	2 LINC batteries	Linc charger	Linc charger power cord

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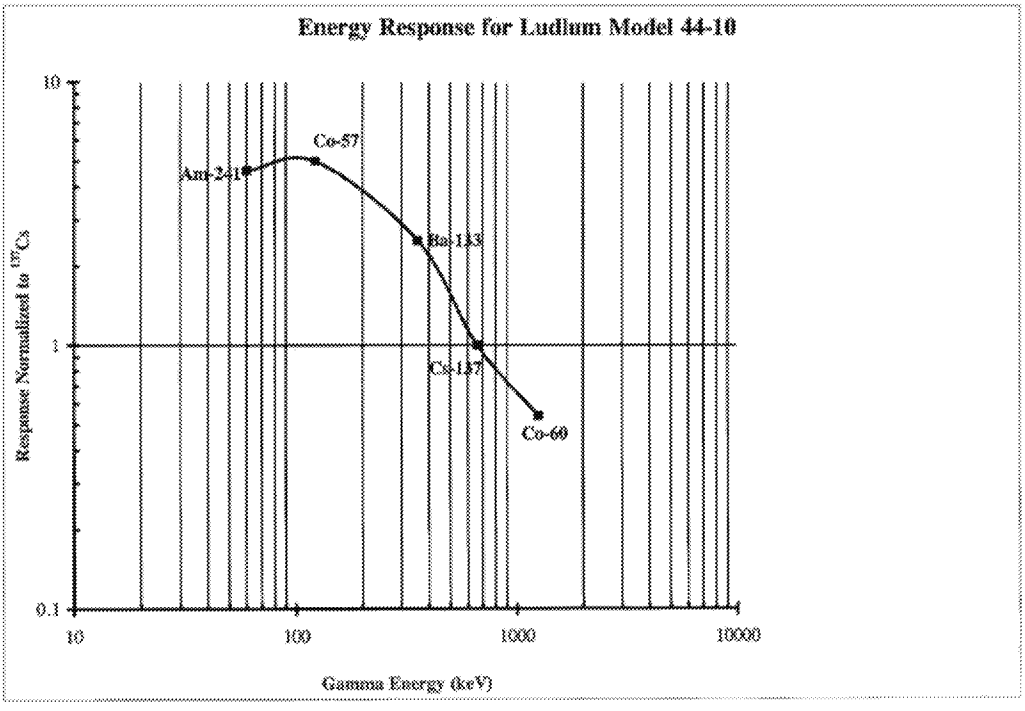
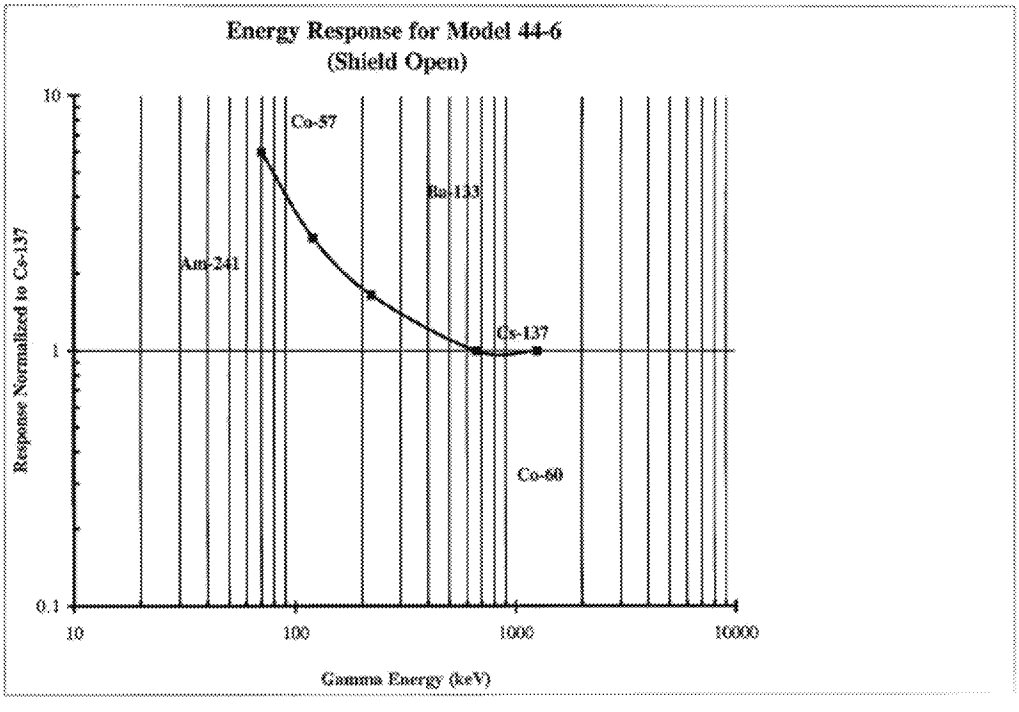
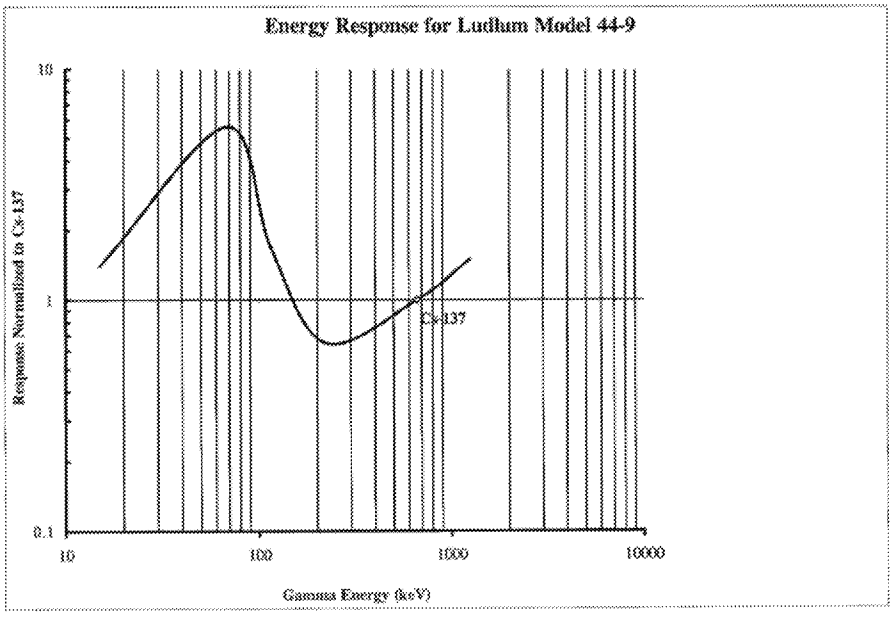
Appendix 16.7 Ludlum Detector Energy Response Curves






Energy Response for Ludlum Model 44-9
Response Normalized to Cs-137
10
1
0.1
Cs-137
10
100
1000
10000
Gamma Energy (keV)

ATTACHMENT F

Field Data Collection Form

Hunters Point Naval Shipyard

StationName	FieldSampleID	SampleMatrix	GammaScan	SampleTop	SampleBottom	DepthUnits	Sampler	SampleDate	SampleTime	NavySampleID	Notes	Latitude	Longitude
RBA1-01	RBA1-01	Soil											
RBA1-02	RBA1-02	Soil											
RBA1-03	RBA1-03	Soil											
RBA1-04	RBA1-04	Soil											
RBA1-05	RBA1-05	Soil											
RBA2-01	RBA2-01	Soil											
RBA2-02	RBA2-02	Soil											
RBA2-03	RBA2-03	Soil											
RBA2-04	RBA2-04	Soil											
RBA2-05	RBA2-05	Soil											
RBA3-01	RBA3-01	Soil											
RBA3-02	RBA3-02	Soil											
RBA3-03	RBA3-03	Soil											
RBA3-04	RBA3-04	Soil											
RBA3-05	RBA3-05	Soil											
RBA4-01	RBA4-01	Soil											
RBA4-02	RBA4-02	Soil											
RBA4-03	RBA4-03	Soil											
RBA4-04	RBA4-04	Soil											
RBA4-05	RBA4-05	Soil											
RBA-SB-01	RBA-SB-01	Soil											
RBA-SB-02	RBA-SB-02	Soil											
RBA-SB-03	RBA-SB-03	Soil											
RBA-SB-04	RBA-SB-04	Soil											
RBA-SB-05	RBA-SB-05	Soil											
RBA-SB-06	RBA-SB-06	Soil											
RBA-SB-07	RBA-SB-07	Soil											
RBA-SB-08	RBA-SB-08	Soil											
RBA-SB-09	RBA-SB-09	Soil											
RBA-SB-10	RBA-SB-10	Soil											

ATTACHMENT G

Maintaining A Field Logbook

FIELD DOCUMENTATION PROCEDURES - MAINTAINING A FIELD LOGBOOK

SOP Number: 03-01-05
Effective Date: 4/22/16

Technical Approval: _____ Date: 4/22/2016

QA Management Approval: _____ Date: 4/22/2016

SOP Description

This Standard Operating Procedure (SOP) establishes general practices and requirements for the use of field logbooks during environmental field activities, including, but not limited to, soil/sediment sampling, groundwater sampling, well installations, surface water sampling, environmental assessments, and environmental audits. SOPs for the use of field logbooks during RCRA Visual Site Inspections and oversight of RCRA Facility Investigations and Remedial Investigations are provided in SOP Nos. 03-03-XX and 03-04-XX, respectively.

Logbooks are used by personnel to document all activities and information gathered in the field. The field logbook entries must be legible, factual, detailed and objective. Proper field documentation is crucial in the logbook because the logbook ultimately may become part of the public record and may be used in future legal actions. The field logbook must provide sufficient documentation to enable participants to reconstruct events that occurred and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings.

General Procedures

Related SOPs

This SOP is to be used in conjunction with other relevant or applicable SOPs found in the following SOP categories:

Category No.	Category Title
02	Field Procedures
03	Field Documentation Procedures
04	Packaging and Shipping Procedures
05	Field Equipment Operation and Maintenance Procedures
06	Groundwater Sampling/Monitoring and Analysis Procedures
07	Soil/Sediment Sampling and Analysis Procedures
08	Surface Water Sampling and Analysis Procedures

09	Health and Safety Procedures
10	Regulatory Compliance Procedures
11	Quality Assurance Procedures
12	Incineration/BIF Sampling and Analysis Procedures
13	Waste Sampling and Analysis Procedures
14	Asbestos Handling
15	Region 5 ESAT-Specific SOPs
16	Region 8 ESAT-Specific SOPs

Equipment and Apparatus

- Field logbooks (Minimally one per person.)
- Black or Blue pens with waterproof ink (preferably)
- Compass (preferably)
- Watch

Type of Field Logbook

The field logbook must be bound and preferably waterproof. A standard surveyor's notebook or the "Rite in the Rain"® Weatherproof Transit Book No. 300, J.L. Darling Corporation, Tacoma, Washington, are types of acceptable notebooks that can be used by TechLaw Holdings and Subsidiary Companies (TechLaw Holdings) personnel. Other notebooks are acceptable, provided that they are bound prior to use in the field. A supply of field notebooks should be kept in each office location.

Maintenance of Field Logbook

The Field Team Leader is responsible for the field logbooks. Each field team member may be required to maintain a field logbook; in addition, the Field Team Leader may designate a team member as the official record keeper. To ensure consistency in documentation, each logbook is to be maintained by the same person for the duration of the project, if feasible. The Field Team Leader must review the logbooks during the environmental field activities to check that the procedures in this SOP are being followed and that the information is entered correctly.

Additionally, it is the responsibility of the Field Team Leader to ensure that RCRA CBI procedures are followed if confidentiality is requested by the facility representative.

Notations in Field Logbook

- All notations in field logbooks should be made in waterproof ink. A standard ball-point pen is acceptable. No erasures may be attempted. Any corrections or deletions are to be made by drawing a single line through the unwanted notation, so that the notation is still legible. The writer then places his/her initials and the date near the deletion. Under no circumstances are pages to be removed from a field logbook.

- All field logbook notations must be legible.

- A separate field logbook must be used for each project. More than one logbook may be used for a single project if the complexity of the site requires that two separate field teams are active on different parts of the facility simultaneously. If more than one logbook is used, each is to be numbered sequentially (e.g., 1 of 3, 2 of 3, 3 of 3). If two or more separate field teams are maintaining logbooks, each team's logbooks are to be numbered sequentially and clearly identifiable (e.g., Team A Book 1 of 2, Team A Book 2 of 2, Team B Book 2 of 2). Each page of the field logbook must be numbered. Each page also must be dated and signed by the writer. For pages only partially filled with text, a diagonal line must be drawn from the end of the text to the bottom of the page. When field activities last more than one day, the next day's documentation begins on the next page of the field logbook. Relevant site information (e.g., weather, site personnel [personnel could change during the course of the field work], strategies) must be listed at the beginning of each day's activities. Also, more than one team member may maintain a logbook, at the discretion of the team leader. The maintenance of a logbook is discussed in more detail in the appropriate Field Documentation SOP (e.g., RCRA VSI, Field Oversight).

- The individual maintaining the logbook must put his/her name and contact information on the inside cover or the first (title) page of the logbook. The first page must include the title of the project, project number, facility name, facility location, EPA Identification Number (if appropriate), date(s) of activity, names and companies of the team members and any other appropriate identifying information. If more than one field logbook is used at a facility, each must contain the required project information on the inside cover or the first (title) page of the logbook.

- Information is generally listed in chronological order in the field logbook and by the time of day. All times are to be entered in a 24-hour format (e.g., 7:00 p.m. is 1900). All factual information obtained during field activities must be recorded in the logbook. Information that is not in or referred to in the logbook may not be used in deliverables associated with the field work. The field logbook contains only factual information--no conclusions are placed in the logbook. Weather conditions are documented at least twice a day and must be noted immediately with any significant weather change (e.g., thunderstorm).

  Often, sketches are preferred to written descriptions (or used in conjunction with), especially where photographs will not be taken. Sketches must include a north arrow, a rough scale and position of buildings, and any other notable features, such as landmarks (trees, streets etc.).

  When photographs are taken, the photograph number is entered into the logbook as well as time of day, compass direction, and a description of what was photographed. Relevant features such as cracks and staining should be documented. See SOP No. 03-02-XX, Taking and Documenting Photographs, for further details.

- The field logbook is the property of the client.[1] The project manager is the custodian of the field logbook for the duration of the project. It must remain in the custody of the project manager (or a designated person) until the conclusion of the field portion of the project. The field logbook is then turned over to the central files.

- Once a field logbook is filled up, the logbook should be scanned and a copy placed in the central files (electronic or hard copy) as soon as possible. Additionally, it is recommended that copies of previous logbooks, instead of original logbooks, are brought into the field to minimize the risk of losing hard copy logbooks.

[1] Work products such as field logbooks that are generated during the performance of government contracts are considered the property of the government client. See SOP No. 11-06-XX for further details regarding document control requirements.

Health and Safety

It is TechLaw Holdings policy to maintain an effective program for control of employee exposure to chemical, radiological, and physical stress which is consistent with OSHA and other applicable and appropriate established standards and requirements.

All field personnel will be provided with appropriate protective clothing and safety equipment. At a minimum, this will include steel-toed shoes, safety glasses, and chemical-resistant gloves.

A site-specific health and safety plan must be developed by the Field Team Leader or designee and approved by the TechLaw Holdings Health and Safety Director prior to implementation in the field. This plan must be reviewed prior to beginning work.

Any deviation(s) from an approved site-specific health and safety plan must be documented in the field logbook.

QA/QC

The Field Team Leader or designee is to conduct periodic QC reviews during a site visit to ensure documentation procedures and administrative requirements have been met.

Comments/Notes

None at this time.

Attachments

None at this time.

References

TechLaw Holdings and Subsidiary Companies, Corporate Quality Management Plan, current version.

TechLaw Holdings and Subsidiary Companies, Health and Safety Program Plan, current version.

TechLaw Holdings and Subsidiary Companies, Security Plan for the Control of Confidential Business Information, current version.

U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001, OSWER Directive 9355.0-14, Washington, D.C., December 1987.

U.S. Environmental Protection Agency, Office of Solid Waste, RCRA Facility Assessment Guidance, October 1986.

RECORD OF CHANGES/REVIEW		
Rev. Number	**Revision/ Review Date**	**Document Name (If other than entire document, list sections)**
03-01-05	4/22/2016	Revised to apply to TechLaw Holdings and Subsidiary Companies.